East Engin.
Library
TS
670
A1
A51

The MONTHLY REVIEW

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

A Society
for the Advancement of the Science of
Electro-Plating

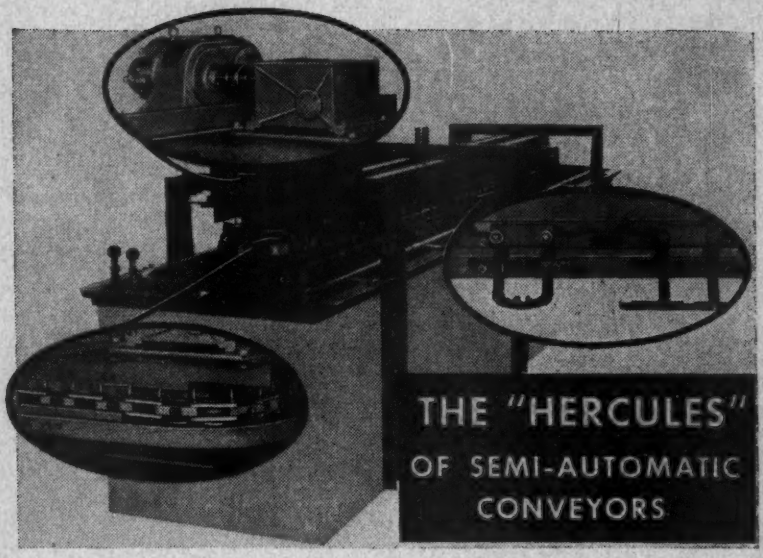
MARCH 1936 · IN THIS ISSUE

Convention Notes	3
Meyer and Helmle—The Electroplating on Lead-Antimony Alloys	7
Roberts — Nickel Plating on Cadmium and Zinc Plated Steel	24
Cinamon — Rhodium Plating	36
Tingley — Are You Intelligent	43
The Abstract Section	48
Branch News	50
Membership Report	62
Buyer's Guide	66
Branch Directory	67

SUBSCRIPTION $3.00 A YEAR

Entered as second class matter at the Post Office at Springfield, Mass., September 8, 1930, under Act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of February 28, 1925, authorized September 3, 1926.



A UNIT OF STRENGTH AND QUALITY, Hanson-Van Winkle-Munning Semi-Automatic Conveyors insure continuous operation and uniform results.

A compact, motor-driven, variable speed transmission — fitted with roller bearings to eliminate friction and wear — drives a conveyor chain of special design at any predetermined speed. The load in the tank and the plating time remain constant assuring uniform thickness of plate and the elimination of various types of rejects which occur when using hand operated still tanks.

Easily removable carriers of any design to meet individual needs can be placed at any desired interval along the chain . . . auxiliary collector fingers can be provided for handling high currents.

H-V-M Semi-Automatic and Full Automatic Conveyors are ruggedly built for long life and represent the bulk of this type of equipment in use in the plating industry. Write for complete details today.

HANSON-VAN WINKLE-MUNNING CO.

MATAWAN, NEW JERSEY

PLANTS: Matawan, New Jersey · Anderson, Indiana

SALES OFFICES: Chicago · Cleveland · Detroit
New Haven · New York · Philadelphia
Pittsburgh · Springfield (Mass.) · Syracuse

The MONTHLY REVIEW

Published by the
AMERICAN ELECTRO-PLATERS' SOCIETY

Publication and Editorial Office
90 Maynard St.
Springfield, Massachusetts

VOL. XXIII MARCH 1936 NO. 3

Convention Notes

Of course by now you have made up your mind that you will attend the Convention in Cleveland next June. What with the benefits to be derived from the papers read, the fine exhibits we may expect at the Show, and the renewal of contact with other members, it is hard to realize that there will be any who will not exert every effort to attend.

When you arrive in Cleveland of course your first stop will be the Carter Hotel where you will retire to the accommodations you thoughtfully reserved some time ago. From it we will endeavor to take you on a very brief trip around the City.

Cleveland was an isolated trading post on the Western Reserve frontier when Moses Cleaveland laid out the Public Square in 1796. Today it is the metropolis of Ohio — the capital of a great empire — the home of more than a million people.

The airview looking South from the lake front will give one an idea how the city has grown since the time the site for the Public Square was purchased for $1.76 from the Connecticut Land Company.. The group located around the new Stadium include the Public Auditorium, and the executive buildings of both city and county.

Cleveland is a city of diversified industry today but the backbone of its development has been its convenient location to the rich Lake Superior iron ore region and the coal and limestone fields of Pennsylvania and Ohio. 2500 plants in Cleveland employ 140,000 wage earners and produce over a billion dollars worth of products annually.

After passing through Playhouse Square we travel eastward towards the city's educational center. At the southern end of Wade Park will be found the buildings of Western Reserve University and Case School of Applied Science. At the latter college

Playhouse Square

the Cleveland Branch has held classes in the past for the benefit of its membership.

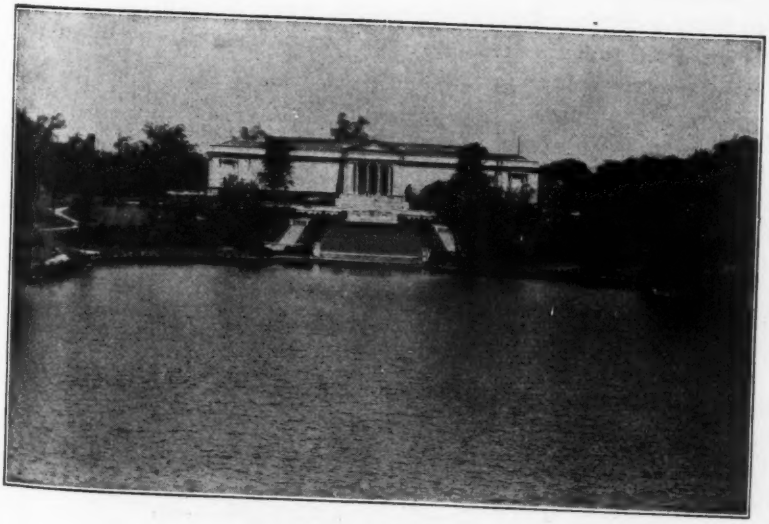
At the northern end of Wade Park across the lagoon will be seen the buildings of the Museum of Art. Here we plan to give the ladies time to renew their acquaintance with some of the Art treasures of the Nation. It is needless to state that more than 300,000 people visit the Museum annually and that 97,000 both adult and high school pupils are given instruction.

Farther East will be found another section of interest to the visitor. Here is located the Garfield Monument.

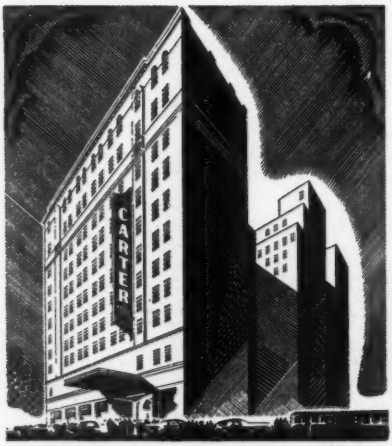
Time and space do not permit of too detailed description of what you may expect and it would not be fair to take away the enjoyment of personal discovery, so we leave you with this thought that no matter where you may care to go, Cleveland's street rail and bus system will take you there. 4500 employees are operating daily 1450 conveyances for your convenience.

Walk, swim, fly, or drive, boat or rail, but come to Cleveland.

Air View of Downtown Cleveland Showing Stadium in Foreground



Cleveland Museum of Art



Carter Hotel

Garfield Monument

A REMINDER TO BRANCH EXHIBITORS

The Convention Committee has reserved ample space at the Cleveland Show for the use of the members who are planning to bring a display of their handiwork to the Convention. It is to be expected that there will be some rivalry between the Branches in regards to their Branch exhibits.

Now is the time for both the Branches and individuals to prepare for these displays. Plan on some keen competition and give yourself the start on the other fellow by making up your samples soon.

Whether as a Branch or individual member assist your Exhibit Committee by writing in and reserving space to show your display in. All Branch and members' displays are to be shown as one group and we wish to hold sufficient space to do justice to their efforts.

Please communicate with Mr. J. C. Singler, 3379 West 95th Street, Cleveland, Ohio, in regards to your plans for use of this space. It is needless to say that all such space is at the disposal of the Branches free of all cost.

J. C. SINGLER,
Chairman Exhibits Committee

The Electroplating *on* Lead-Antimony *Alloys*

WALTER R. MEYER and CLARENCE C. HELMLE

Read at Bridgeport 1935 Convention

HYPO-EUTECTIC ALLOYS of lead and antimony are used extensively in the industry, and they present peculiar problems to the electroplater which have increased with the advent of chromium plating. Antimony is added to lead to give increased hardness and stiffness and the resultant alloys find use, for example, in casket hardware trim, novelties, percolator spouts and handles, and lamp fixtures. Most castings are made by "slush" casting in metal molds.

The difficulties encountered in electroplating on lead-antimony alloys are due chiefly to their softness and to the chemical activity of both lead and antimony which render difficult the preparation of a chemically clean surface. Due to the brief time available for the presentation of this paper, we will present a condensed discussion of numerous experiments and observations which have extended over the past four years.

POLISHING AND BUFFING

Lead alloys undergo considerable plastic flow during polishing, which necessitates a special technique called "sand-bobbing" in which a walrushide wheel, oil, and pumice or sand are employed. This process cuts the metal down, preparing it for the buffing operation. In buffing, high peripheral speed and high pressures must be avoided to prevent plastic flow. A high color is not necessary, as the alloys undergo considerable etching in the cleaning processes, although coloring is frequently done as a cleaning operation, using a lime compound.

CLEANING

Because of the rapidity with which most cleaners attack lead, heavy buffing compounds or other dirt should be removed prior to placing in the alkaline cleaner. For this purpose, solvent cleaners or solvent-vapor degreasers are recommended. Lead is very easily oxidized in the air and in cleaning solutions and

to add to this difficulty it forms insoluble salts with the acids most commonly used, namely, sulfuric and hydrochloric acids. The lead-antimony alloys are best cleaned cathodically because this method materially lessens the length of time they must remain in the cleaner. Strong caustic cleaners etch rapidly and certain soaps form insoluble lead soaps which are very difficult to remove. Four to six ounces of tri-sodium phosphate to a gallon of water have proved to be very satisfactory.

After the cleaner has been in use for some time, a black smut will begin to form on the work. This is not due to oxidation, but is due to the plating out of metals which have dissolved in the cleaning solution. Analyses of typical smuts have found lead, tin, copper, iron and zinc. The copper, tin and zinc were present because these metals were cleaned in the cleaner used for lead-antimony alloys.

It has been frequently stated that the reversal of current, that is, to make the work anodic for a few seconds, will plate off this smut. This is only true if lead and zinc are present, because their oxides are soluble in caustic soda to form sodium plumbite and sodium zincate respectively. If copper and iron are present, and they usually are, they will be merely oxidized to their respective oxides or remain unaffected. The persistence of smut or, in some cases, an increase in discoloration of the work has been of frequent observation when the current has been reversed in cleaning.

The question then confronts us, "Should we use reversal of current or not?" Our answer is an unqualified "Yes." The reasons are several: (1) Some metals in the smut, as zinc or lead, are completely de-plated; (2) Copper and iron are oxidized so that they are more readily removed in the subsequent acid dips; and (3) The lead-antimony alloy is oxidized, resulting in an etched surface which, after proper treatment, will give a more adherent plate than an unetched surface.

The reversal of current can be done in the regular cleaning solution, but this will hasten the smut formation in direct cleaning. We recommend the reversal be done in a separate cleaning solution, using 4 ounces of sodium carbonate to a gallon of water, and a reversal time of fifteen seconds. In this solution, the oxides of lead and antimony are insoluble and hence any tendency to over-etch will be avoided. If a cleaner with tri-sodium phosphate or caustic soda is used for reversal, the etching is much more

pronounced due to the continuous dissolving of the anodically formed lead and antimony oxides.

ALKALINE DIPPING

After reversal of the current, the work is rinsed in clean water and then immersed in a warm solution (150°F.) of two ounces of caustic soda to a gallon of water. If the reversal is properly done, a clean white surface will result after the hot caustic dip. No oxide or plated smut should be present, and the surface should be smooth and crystalline. The warm caustic dip is essential for securing maximum adhesion of subsequent coatings.

ACID DIPPING

Regardless of the plate to be deposited on the lead-antimony alloy, an acid dip should be used after the warm caustic dip. This is necessary to neutralize the alkali trapped in the pores of the metal, which, if present, may precipitate basic salts on entry into the plating solution, resulting in blistering.

The choice of the acid to use is complicated by the insolubility of most lead salts and by the slow reactivity of antimony. We shall now consider in order the various acids for dipping purposes.

NITRIC ACID

From theoretical considerations it might appear that nitric acid would be the ideal acid dip. Its lead salt is soluble, it is free rinsing, and it forms no precipitate in the nickel plating solution. For pure lead alloys and low antimony alloys (below five per cent) excellent results were obtained with a ten per cent nitric acid dip. Higher antimony alloys or stronger acid result in either preferential solution of lead leaving a metallic antimony smut, or oxidation of the antimony.

ACETIC ACID

The lead salt of acetic acid is soluble, but the acid has little effect on the antimony. It gives a false water-break and for all concentrations poor results were obtained.

SULFURIC ACID

Sulfuric acid has good solvent action on iron or zinc oxides in the smut, but its lead salt is insoluble, resulting in a more or less invisible film of insoluble lead sulfate forming on the work. An

acidified ammonium acetate dip used to dissolve this film gave unaccountably poorer results. An acidified ammonium citrate dip, however, gave excellent results.

HYDROCHLORIC ACID

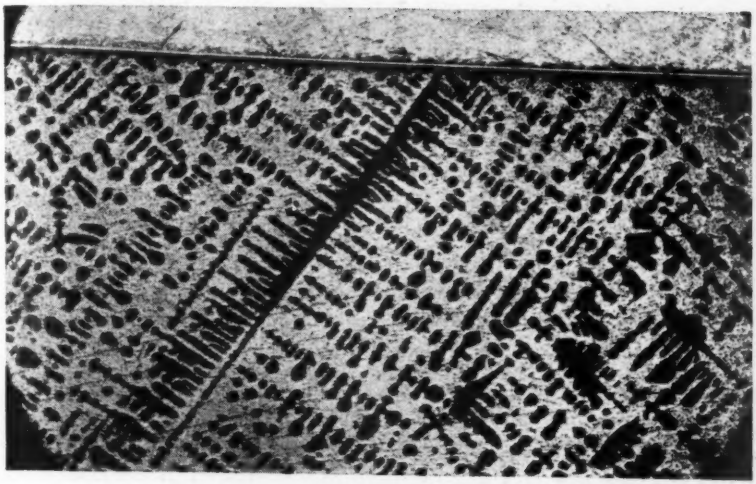
A twenty per cent solution of hydrochloric acid gave excellent results in practice. Lead chloride although only very slightly soluble in cold water (.7%) is over 200 times more soluble than lead sulfate. Ammonium citrate was not of advantage.

Electrolytic pickling was tried, but the results were no more favorable than with simple immersion.

PLATING

For nickel plating, the work is rinsed after pickling and transferred without delay to a warm nickel bath. Contact should be immediate and positive. As ductile a nickel as possible should be applied, as a hard nickel will result in cracking, which will be transmitted to the basis metal. Some writers have claimed these cracks to be the result of the cold worked strains in the basis metal. For various metallurgical reasons this view is difficult to accept. We have produced such cracks in nickel plating on annealed lead. The cracks result from several basic factors: First, the strain forces in the nickel are large in comparison to the force of adhesion; secondly, the tensile strength of the lead alloy is only about one-fifth that of the nickel plate; lastly, the coefficient of expansion of lead is over twice that of nickel. It is difficult, therefore, to deposit over .0005″ of nickel directly on lead without obtaining a cracked deposit.

For this reason and others, lead-antimony alloys are frequently copper plated before nickel plating. The work is dipped in a three per cent sodium cyanide solution after the rinse from the hydrochloric acid dip, and then transferred to a warm cyanide copper solution and plated at 5 amperes per square foot. The free cyanide content is best held below one ounce per gallon. A .0003″ copper plate should be applied. The work may be copper plated in an acid copper bath after .0001″ has been deposited in the cyanide bath. Care should be taken to deposit a ductile nickel over the copper. We strongly advise against copper strikes or thin copper deposits (less than .0001″) because of their porosity which may lead to blistering of the nickel.



Slide No. 2

Slide No. 3

Copper has a coefficient of expansion between lead and nickel, and helps to buffer the strains inherent in the nickel.

COLORING OF NICKEL

The coloring of the nickel should be done with as little pressure and heating as possible. Hard buffing will cause even well plated coatings to blister or peel after chrome plating. Plastic flow of the lead alloy has been observed under the nickel plate, due to hard coloring of the nickel.

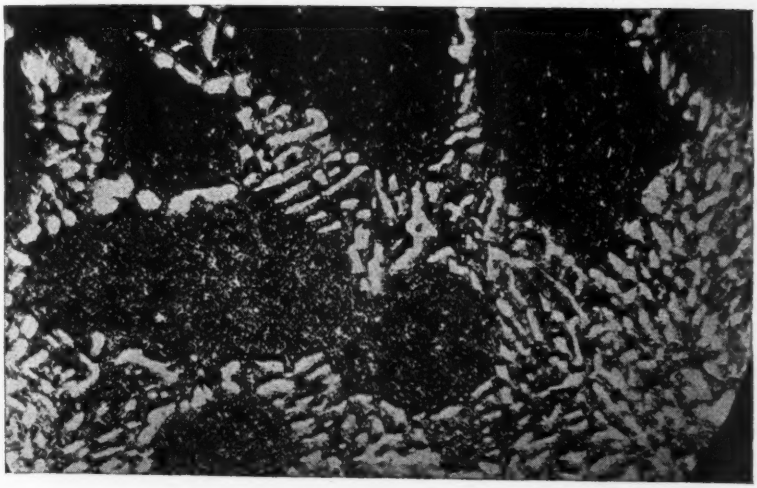
CHROME PLATING

Nickel plated lead-antimony alloys must be chromed with great care. Electrocleaning previous to chrome plating is not recommended. The plating time should not exceed three minutes and every means taken to prevent burning of the chromium plate. Burning necessitates hard buffing under which blistering may result even with the most carefully prepared nickel coatings. This factor has probably been the cause of more peeling and blistering of nickel-chrome deposits on lead alloys than any other one cause.

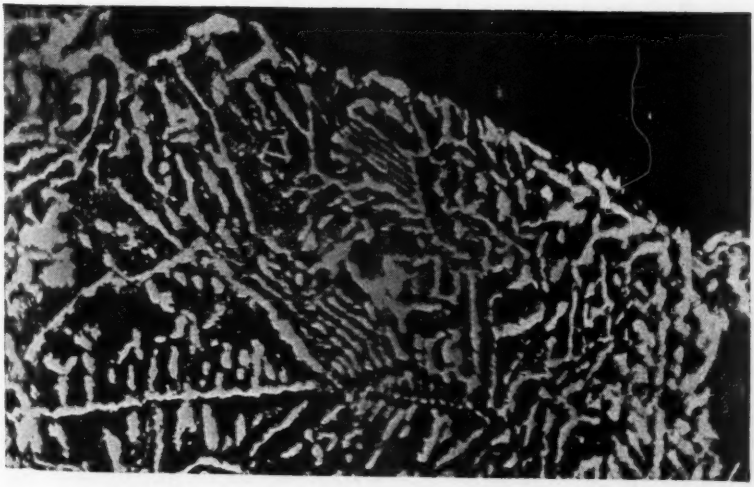
In summary, the following sequences are suggested:

I. For nickel coatings less than .0003".

1. Solvent or vapor clean.
2. Electroclean as cathode 1-3 minutes at 30-50 amp/ft.^{2} tri-sodium phosphate 4-6 oz/gal.
3. Reverse clean—as anode—15 seconds at 30-50 amp/ft.^{2} in 4 oz. Na_2CO_3 per gal.
4. Dip in 2 oz. NaOH/gal. at 150° F.
5. Dip in 20 per cent HCl.
6. Nickel plate—warm solution 100° F.
7. Color.
8. Wipe clean if necessary.
9. Chrome—not over 3 minutes at 100 amp/ft^2.



Slide No. 4



Slide No. 5

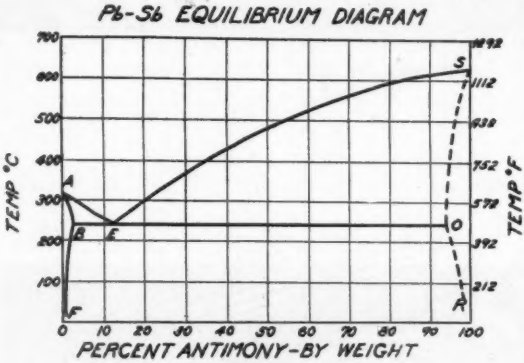
II. For nickel coatings over .0003". Proceed through sequence #5 in Method I.

6. Dip in 3 per cent NaCN solution.

7. Cyanide copper plate .0003" at 5 amp/ft^2 or
Cyanide copper plate .0001".
Rinse.
Acid dip (10% H_2SO_4).
Acid copper plate .0002".

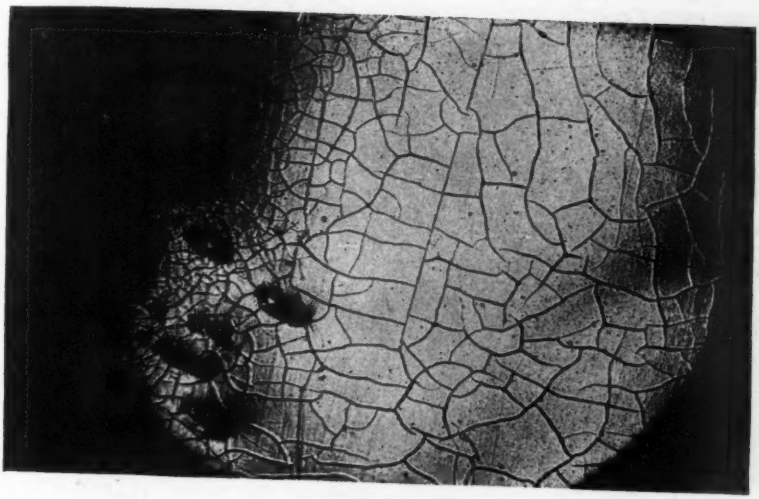
8. Nickel plate, and so on, as in I.

In conclusion, may we state that this data has proved itself both experimentally and in practice, and we sincerely hope that it may prove to be of value to other electroplaters who have had similar problems and troubles confront them.

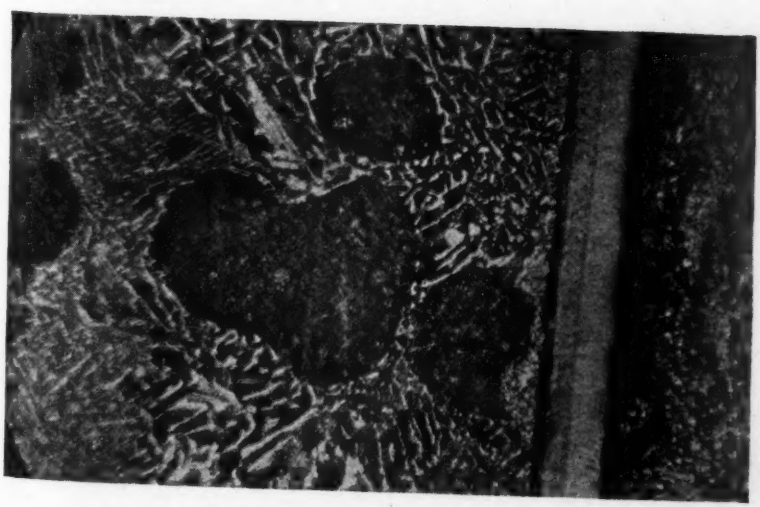


Slide No. 1

(*Slide I*) We have here the equilibrium diagram between lead and antimony. You will notice this point is twelve per cent antimony. Notice that the lead-antimony alloys are capable of hardening by dispersion of antimony in the lead, due to difference in solubility at the eutectic temperature and at room temperature. The solid solubility of antimony at the eutectic temperature is 2.45 per cent. That is not the eutectic composition, but the solid solubility of antimony at the eutectic temperature. There is quite a difference. These alloys can undergo dispersion hardening on cooling. The antimony is soluble to some extent in the lead, you see, at this temperature. Then as the temperature drops, the solid solubility of antimony in lead decreases and the antimony can precipitate out. After a while you may get agglomeration of the antimony and subsequent softening. This diagram has been worked out by Dean, Foster and men from the Western Electric laboratories.



Slide No. 6



Slide No. 7

(*Slide II*) This is a picture of the dendritic structure that forms with lead-antimony alloys. Notice this beautiful dendritic structure. That means it looks like a tree. The white zone is the eutectic; the black spots that you see are essentially lead with some solid solubility of the antimony. Notice the thin plate at the top.

(*Slide III*) This is the dendrites again, at a slightly greater magnification. It is not a very good picture. I did not get good etching on the lead surfaces.

(*Slide IV*) Now we can see the eutectic a little more clearly. Notice it consists of antimony and lead crystals. This is a lead crystal here and this is the eutectic region where you have the antimony alloys dispersed.

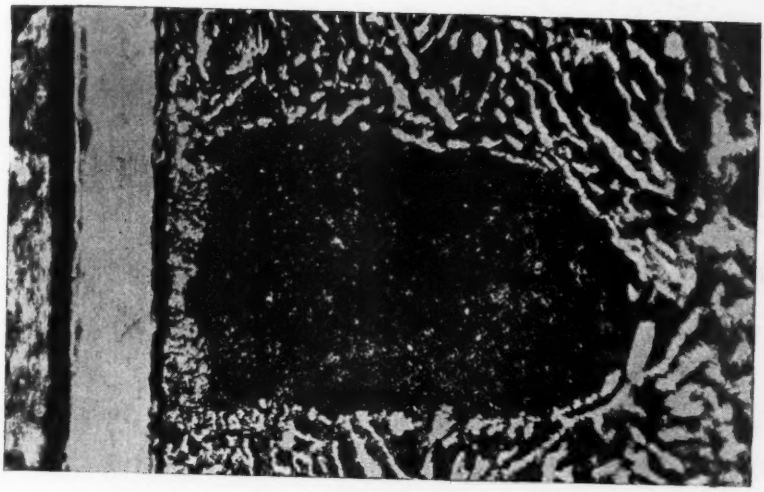
(*Slide V*) This is a picture taken at 2,500 magnifications of the eutectic. This is antimony and lead. The solid solubility of lead in antimony has not been exactly determined as yet.

(*Slide VI*) Here is some cracking of the nickel plate on lead alloys when care was not taken to deposit a ductile nickel.

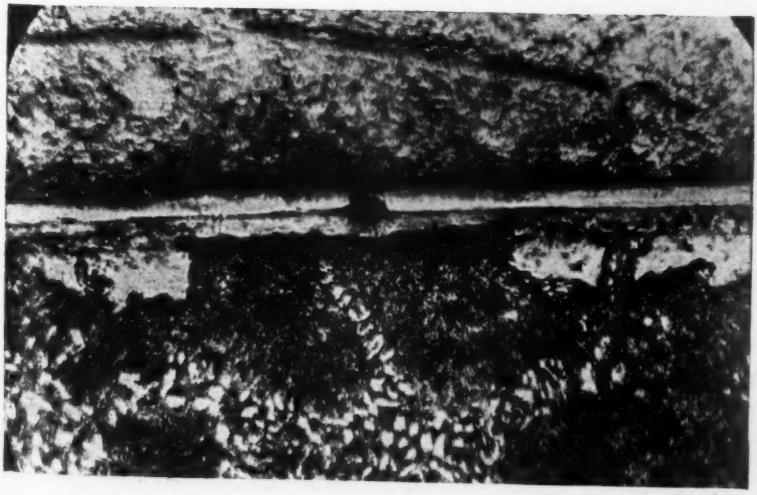
(*Slide VII*) Here is a picture showing the effect of cold-working on the solid solubility of antimony in lead with the precipitation of antimony and the penetration of the cold-work beneath the surface. It varies from a quarter of a mil to a half mil. The copper is one half a mil; nickel, half a mil; the depth of penetration approximately half a mil. This is the lead crystal here. The eutectic is over here and along in here.

(*Slide VIII*) This is the picture I showed you yesterday, which gives you a better example of the effect of cold-working on the lead alloys. Nickel, copper and precipitation (illustrating). This is taken with an oil immersion at about 2,000 magnification.

(*Slide IX*) I showed you this picture yesterday. I want to come back to it again to bring out some other points. This is the lead antimony alloy. It was copper plated and nickel plated. Cracks appeared in the nickel plate. We showed that the crack extended through the nickel, but did not run through the copper plate. They stopped there. Notice this remarkable thing. I cannot account for it, and I have other pictures to show it. That is the diffusion of copper in lead is extremely rapid. This specimen was heated in an oven at 140 degrees C. for fifty hours. Notice the entire copper plate in this spot is diffused. What makes it



Slide No. 8



Slide No. 9

mystifying is that the solid solubility of copper in lead is practically nil and the liquid solubility of lead in copper is very low also.

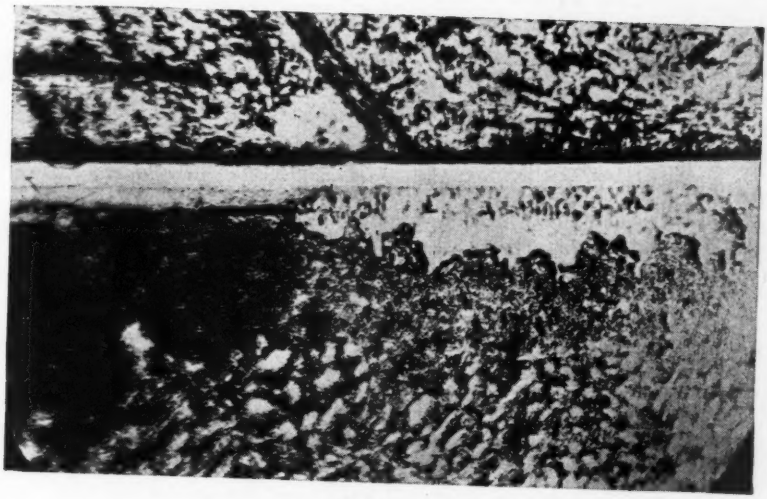
(*Slide X*) Here is another slide to show the diffusion of the copper into the lead. This is the edge of the nickel plate; this is the diffusion zone. Notice some undiffused copper. There are a great many factors determining the rate of diffusion of the copper into the lead. We do not know the exact reason why it did not diffuse there and it has diffused there. Your answer is as good as ours.

(*Slide XI*) I just wanted to show you this slide again to show that you can get the same effect of variability in the rate of diffusion of copper in zinc, similar to what we have just shown of copper on lead.

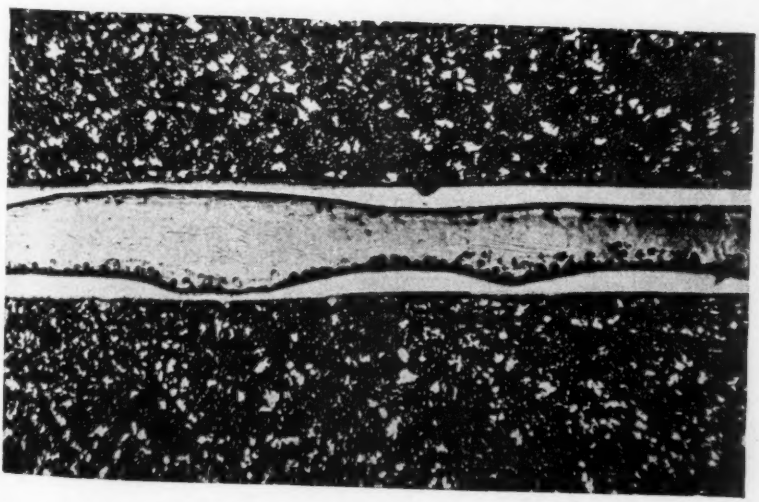
(*Slide XII*) This picture is not very clear, but to me it represents a very remarkable thing. It was taken on top of a nickel-chrome deposit. We had had a thousandth of an inch of nickel and two hundred thousandths of an inch of chrome. I was examining it under the microscope with oblique illumination and could see the dendritic structure of the lead-antimony alloy beneath. I could not develop the picture any better. That is the way I saw it under the microscope. If you will look carefully, you can see a dendrite running over here, and there is a visible crystal structure. It shows that this process that we recommend to you for cleaning does clean, to give you the true crystalline structure of the lead-antimony alloy itself. We shall now show you a couple of slides made from this plate.

(*Slide XIII*) The plate that you just saw was subjected to a cathodic hydrogen. Notice the blistering of the deposit, down there and up in the corner; the cracking, running from one blister to another; and notice the cracking transmitted to the basis metal over in there. It cannot be said that this particular plate was not plated with good technique when you can see the crystal structure of the basis metal showing through the nickel-chrome deposit, and still we had peeling. Do not always think cleaning is going to be the answer for peeling and blistering of your deposits. I assure you it is not.

(*Slide XIV*) This picture is taken looking into one of those little holes. Can you slide the other picture back for a moment?



Slide No. 10



Slide No. 11

We will take a peek into one of these little holes that you saw here. This magnification is low. This is taken with a fifteen times magnification. Of course, your screen gives you a great deal more magnification. We wanted to see whether the crystal structure of the lead was exposed. We saw it through the nickel and chrome plate, and we can see it in this slide also.

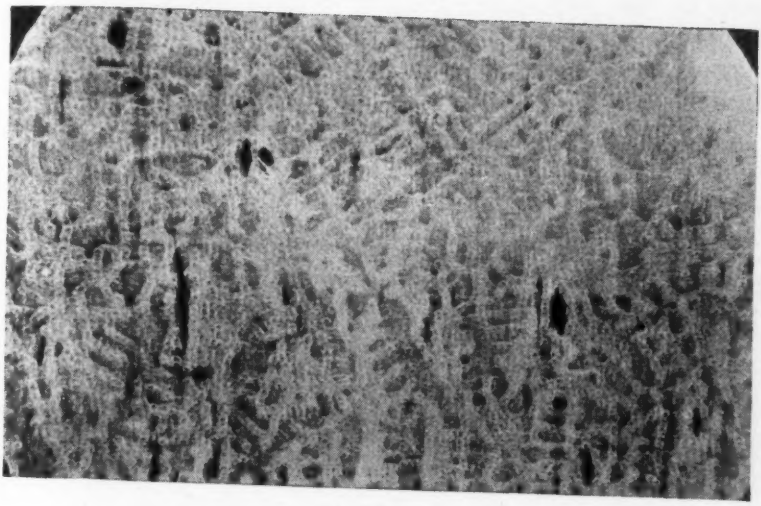
There is the eutectic structure clearly visible when that little piece of the nickel plate blistered off. This is the edge of the blister. This is the edge of the nickel. It is fogged, because I could not get the whole thing in focus because of the high magnification, but you can see the lead crystal and the eutectic, the antimony and lead.

(*Slide XV*) This picture illustrates the effect of various acids and alkalis which attack the intergranular boundary. This particular idea may also have a bearing on the relative embrittling effect of acids on steel, as mentioned by Mr. Candee yesterday. Notice the way the cleaning solution has penetrated around the grain of the lead alloy. This was copper plated and the copper plated down here and all around the crystal. You might say, "How can it plate completely around it?" We don't know whether it plated completely around it because you have a sphere there and we only have a plane section. It may not have plated in back. This was copper-nickel plated. In this case the copper was all around the ring boundary where the cleaning solution had happened to penetrate the pit. Then there is the nickel on top. (Applause)

CHAIRMAN CHAMBERLAIN: Are there any questions on this paper by Mr. Meyer?

MR. HOGABOOM: Again I must congratulate Mr. Meyer upon his good work. I see he has been a good student of what is under the plate. He has shown very cleverly the effect of these different things and the necessity of the platers having a better understanding of metallurgy.

MR. GRAHAM: I second what Mr. Hogaboom said. I hope that the Society can arrange, in publishing a paper of this kind, to reproduce the photographs. The photographs are the meat of the paper. Furthermore, the author is to be congratulated on the excellent photographs he has obtained. It is a rather difficult thing to get pictures of cross-sections of some of the points he has



Slide No. 12

Slide No. 13

shown. With the amount of effort that has been so successful in the results obtained, I think the paper should include a reproduction of those photographs. I hope it is possible to have them included.

I am wondering, where it was found that the copper had apparently diffused, whether that diffusion is not explainable on the basis of the diffusion of copper into the antimony or antimony into copper. You were referring to it primarily from the point of view of the reaction between lead and copper. While it was not entirely clear as you showed the slide, it did appear that it might have occurred first at that cold-worked surface from which the antimony was precipitated, and, secondly, at the eutectic areas where there would be a higher concentration of antimony.

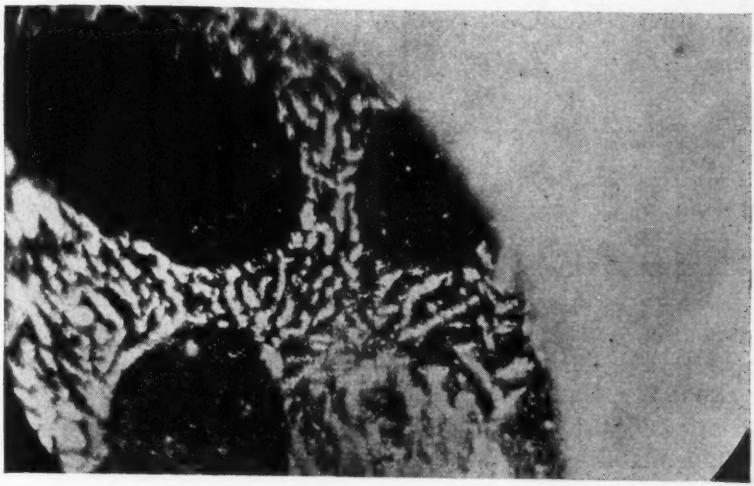
MR. MEYER: We thought of that problem in looking over the diffusion, but the zone seemed to penetrate right across the solid solution of antimony in lead and the eutectics as well. There is very little I can say about it. I am just mystified, that is all.

MR HOGABOOM: I should like to ask Mr. Meyer if he aged any of the antimonial lead, similar to what they did at Bell Telephone laboratories, and found the difference in the eutectics.

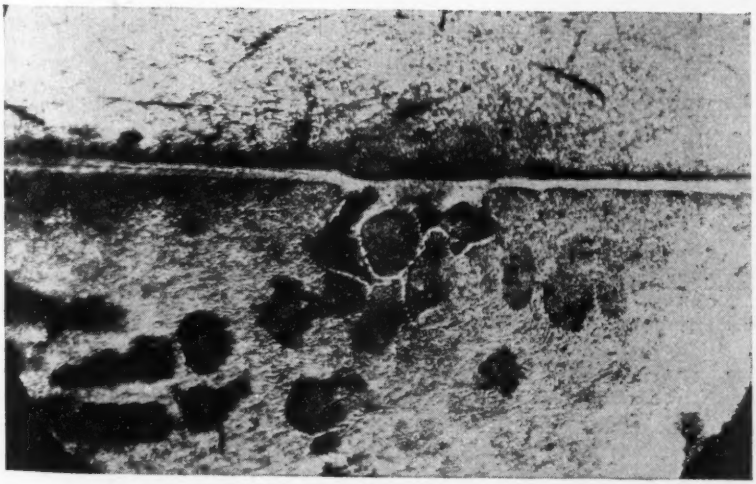
MR. MEYER: There is no difference in the eutectic itself. The eutectic of lead and antimony is fixed.

MR. HOGABOOM: I mean the solubility.

MR. MEYER: The solid solubility does vary, and it does vary greatly with the temperature. As I mentioned, it starts with 2.45 per cent antimony at the eutectic temperature, which is around, I believe, 400 degrees, or along in there. Then the solid solubility of antimony in the lead drops until at room temperature it is only about a quarter of a per cent. If you get a sudden chilling of the alloy, the antimony does not have a chance to precipitate out and then you get a lower precipitation and the so-called dispersion hardening. Mr. Hogaboom mentioned the following effect: that is, the agglomeration of the finely dispersed antimony to form the larger antimony particles which will give you a subsequently softer antimony alloy. If the antimony is increased much over 2.45 per cent, which represents the limit of solid solubility, the effect of dispersion hardening is diminished due to the fact that you already have antimony nuclei for the dispersed antimony to grow around.



Slide No. 14



Slide No. 15

Nickel Plating on **Cadmium** *and* **Zinc Plated** *Steel*

by JOHN L. ROBERTS, JR.
Member of the Philadelphia Branch

at Philadelphia Branch Meeting
DECEMBER 20th, 1935

Causes of Corrosion:

One of the rarest things on the face of the earth is pure iron in the native state. As a matter of fact Mr. Ripley not so long ago in his "Believe it or Not" column instanced the case of a solid column of metallic iron found somewhere in the far East without a trace of rust upon it, and to further challenge our belief the column dates back before the advent of the new Calendar.

The thing we all know so well as rust is iron oxide with a certain amount of water added to it in chemical combination. Now, one of the peculiarities of the rusting of iron is that it occurs in layers. The first layer known as ferrous oxide is slightly green in color and contains less oxygen than any of the succeeding layers. It also contains less water. Now the more heavily a piece of iron or steel becomes rusted, the greater becomes its weight due to the extra oxygen and water absorbed.

We see, therefore, in order to produce corrosion, two things are necessary — first, water vapor; and second an oxydizing agent.

We are all familiar with the fact that steel will rust much more quickly in a salt atmosphere than under ordinary weather conditions.

This is evidenced by the fact that we use the salt spray cabinet to obtain accelerated rates of corrosion.

Therefore, in addition to water vapor and oxygen, it seems that salts of acids also have an important role to play.

Now to sum up all these effects let us take three beakers; fill the first with distilled water, the second with ordinary tap water, and the third with water to which some salt has been added. Now, take three pieces of cleaned steel and dip them respectively into the three solutions and hang them up to dry. We will note

the following results;—the steel which was dipped in the salt water will show the first signs of rust; next, the one dipped in the tap water, and thirdly the one that was dipped in the distilled water.

It was seen that the salt evidently had the greatest influence on the rate of corrosion. Now, it so happens that a salt solution has greater electrical conductivity than either tap or distilled water, and we can readily see, why we find salt used in solutions to both increase electrical conductivity and also increase the rate of corrosion at the anode.

Prevention of Corrosion:

In order to inhibit or prevent this corrosion of steel, many methods have been introduced, some are practically permanent, while others are comparatively temporary.

Among the permanent methods we may class the coating of the base metal with zinc or cadmium.

Often times it is not necessary to protect the metal permanently. In cases like this if the base metal is to be coated with paint or lacquer, it may be treated in chromic acid solutions or possibly phosphoric acid. This treatment not only makes the paint or lacquer stick better, but also helps prevent corrosion afterwards.

Choosing a metal for rust protection.

One of the first things to be considered in the finish of a manufactured article is its resistance to atmospheric corrosion.

The question at once arises as to the proper metal or combination of metals to use to secure this protection.

If our base metal consists of copper or brass, nickel alone is sufficient to insure protection, due to their relative positions in the electromotive series of metals.

However if the base metal consists of any of the metals belonging to the iron group our thoughts immediately go to cadmium or zinc. We would be very glad to consider magnesium or aluminum if these metals could be deposited from aqueous solutions but as yet no satisfactory method has been developed for the

economical coating of iron or steel with either of these valuable materials.

Therefore in choosing our protective metal we must decide between zinc and cadmium. Both of these metals today offer practically the same corrosion resistance if they are deposited in equal thicknesses. Cadmium has the edge on zinc in marine atmospheres as sea coast tests have shown, but in industrial atmospheres zinc is slightly better.

We are then left with the consideration of appearance, since our metals are both nearly equal in their protective qualities.

Since the automotive trade has recently practically bought up the cadmium market some striking developments have been attained in bright zinc deposits. In fact it is now difficult to tell one of the new *bright* zinc deposits from cadmium, and if we are to judge by appearance alone we are naturally influenced by the vastly cheaper zinc finish, which has all of the fine rust protective qualities of cadmium, and fine appearance as well.

ELECTROMOTIVE SERIES

Those of us who have been fortunate enough to find the time to study a little bit about the reasons why one metal acts better as a corrosion retardent than another, will doubtless immediately draw to mind the electromotive series of metals.

Nearly all of us are acquainted with the fact that when two dissimilar metals are placed in a solution containing acid, and if a wire be connected between the two metals outside the jar containing the solution, and a voltmeter be placed in the circuit, we will note that a voltage will be set up between the two metals.

This voltage is dependent upon two things. The kind of metals used for our battery and their concentration in the sulfuric acid electrolyte.

If our metals be zinc and gold we would find quite a considerable voltage set up for our cell. However, if we should use zinc and cadmium we would note only a very slight movement of our voltmeter needle. This is because of the wide separation of the metals in the electromotive series in the case of zinc and gold, and in the second instance a small needle deflection due to the narrow separation of cadmium and zinc.

Upon examination of the series of metals we find that the alkaline earth metals are most base or highly negative; then as we approach hydrogen (which is classed as a metal due to its electrode qualities) we pass from the base to the noble metals as follows:

Potassium	—	-2.9	Starting at the top of the list we will
Sodium	—	-2.71	find that each one of the preceding
Magnesium	—	-1.81	metals will protect the one below in
Aluminum	—	-1.33	the series from corrosion, and the
Zinc	—	- .77	wider separation we make in our se-
Chromium	—	- .47	lection, the greater will be this pro-
Cadmium	—	- .42	tection due to the greater difference
Iron	—	- .34	in voltage between the two metals.
Cobalt	—	- .23	Thus in our battery of zinc and cop-
Nickel	—	- .20	per, (two of the most widely sepa-
Tin	—	- .146	rated metals) we will find when our
Lead	—	- .132	circuit is closed, and the current com-
Hydrogen	—	0 .000	mences to flow thru the circuit, that
Copper	—	+ .34	the zinc will become negative and
Mercury	—	+ .79	the copper positive.
Silver	—	+ .79	The current will flow thru the circuit
Platinum	—	+ .86	from the positive (copper side) and
Gold	—	+ .985	back to the negative (zinc side). In-

side of the cell the current will flow from the zinc to the copper. This means that the zinc will corrode and go into solution as zinc sulfate, while the copper which is in solution as copper sulfate, will deposit itself on the copper electrode.

Here we have an actual case of the zinc performing a protective duty to the copper electrode, and we will find that as long as the current continues to flow, our zinc will continue to perform this protective duty.

I mention this example to simply demonstrate the value of a working knowledge of this metal potential series.

It is also useful in chemical analyses for the determination of noble metals. We all are familiar with the so-called throwing down of gold from its solutions by means of zinc dust or powdered zinc. Well any one of the metals above gold in the series would have

done exactly the same thing, but we chose zinc because of its extreme negative position.

The same thing applies to cyanide or chloride solutions, or even water, as we shall see when we consider the protective value of cadmium, or some metal equally negative with respect to iron.

Recently it has been my pleasure to do some analytical work in boiler feed water control. As an example of this topic while discussing the different methods of rust prevention of water tubes in the large boilers used for process steam, our engineer told me of a curious incident:

It seems that the hulls of sea going vessels often become intensely corroded due to the action of the salt water after long ocean voyages. Many of the South American ships have to deliver their cargoes several miles up the Amazon River in South America.

It had always been a puzzle to engineers and sea captains just why practically all this corrosion would miraculously disappear after a few days in these waters.

The Amazon River believe it or not, was found to be fairly alive with electric eels. The kind that kill their prey with an electric discharge from their bodies. The young engineer hardly daring to tell what he thought for fear of ridicule decided to try a little experiment. Of course he did not try using an eel, but he did try putting up an electric potential on a piece of steel heavily corroded with rust and he watched it closely day by day. The result of his experiment has given the world a new means of combating corrosion in boiler tubes. A small negative potential is set up on the inside of the tubes causing the evolution of hydrogen gas to take place. The reducing action of this gas prevents rusting. Whether our electric eel friends in the Amazon River really are responsible for cleaning the ship hulls is a matter for conjecture, but they did serve to give an idea which when tried out got fine results.

PROTECTIVE VALUE OF CADMIUM

Assuming we have chosen cadmium for the above reasons let us find where it stands in the electromotive series of metals. Upon examination of the series we find it stands just below zinc

and just above iron. We can readily see then why it forms a natural protection to iron.

Let us coat a piece of steel with cadmium, scratch a small space on the steel bare of the cadmium, and place the article in a beaker of ordinary tap water. We will notice in a short time that a very fine film of bubbles will appear on the place we have scratched bare. These are due to hydrogen evolution on the bare steel due to the electromotive force set up between the cadmium and the steel, and as long as they appear our steel will not rust, due to the reducing action of hydrogen set free. Since we have therefore, a miniature battery with our combination of metals, and since hydrogen gas is liberated at the cathodic steel, we would find that oxygen is also being liberated on the cadmium side of our cell, and it has actually been proven that the cadmium is corroding due to the liberation of this oxygen.

PROTECTIVE VALUE OF NICKEL

Supposing we had chosen a more noble metal such as nickel for our protective coating, and proceed exactly the same with the battery experiment. We would find the exact opposite effect taking place.

Since nickel is electro positive to steel we would find oxygen gas evolving from the steel, and hydrogen coming from the nickel with the steel corroding at the expense of the nickel.

Steel will therefore corrode faster in the presence of nickel alone if the nickel layer is porous, than it would if the nickel were not present.

However if our base metal were copper or brass the opposite effect would again take place, with the nickel affording good protection to the corrosive action of the water.

PROTECTIVE VALUE OF CADMIUM AND NICKEL

If we coat our base metal of steel first with a coating of cadmium, and then cover this with a very thin coating of nickel, we have a combination of potentials set up for our experiment. We will find that the cadmium will continue to apply its electro positive protecting potential, and since the nickel does not come

in direct contact with the steel, the electro positive effect will be negligible in industrial atmospheres, and we will have a finish that will wear well, withstand much handling without staining due to finger marks, and retain all of the excellent appearance of our bright cadmium deposit.

We have therefore, retained all of the rust protective qualities of cadmium, with the lasting tarnish resisting qualities of nickel.

Had we chosen zinc for our rust resisting coating instead of cadmium, we would have had equally good results if we had been fortunate enough to entirely cover the zinc deposit with the nickel coating, and that is a story in itself.

We must now find what conditions are necessary to plate a good deposit of nickel on top of cadmium.

It is first necessary to select a good nickel solution.

It is not necessary to select a strictly die cast solution as must be used on zinc base die castings. Cadmium does not exert the same solution pressure in a nickel plating solution that zinc does.

If a piece of zinc be placed in a nickel solution it will tend to dissolve with a potential of -.8 volts forcing it into solution, and displacing a loosely adherent coating of nickel on the surface of the zinc.

Cadmium on the other hand, while tending to act in a similar fashion does so with a much smaller potential, only -.4 volts instead of -.8 volts as is the case with zinc.

This coating of nickel by immersion as it is called, is entirely independent of the electric current, and is capable of causing untold trouble if proper means of controlling it are not taken.

There are three methods in use today which have been employed successfully to overcome this tendency.

The first method recommended by Dr. A. K. Graham consists of a striking or flashing nickel bath for plating zinc or cadmium for a short time at an extremely high current density (about 46 amps per sq. ft.).

The second method makes use of certain organic salts such as

sodium citrate or tartrate, or inorganic salts such as sodium or magnesium sulfate.

The third, uses a metal quite positive in potential which is used as an (in between) coating. However this method requires the use of an extra plating bath and as will be seen, is entirely unnecessary.

Our choice therefore, lies in the selection of either sodium or magnesium sulfate to secure the necessary characteristics to prevent the deposition of nickel by immersion, or in the use of Dr. Graham's striking solution with a high initial current density for a short time (75 seconds recommended by him).

If we choose the second method to secure these results, that is in the use of magnesium or sodium sulfates, or some suitable organic salt. We will be governed in our selection by choosing the salt most easily controlled in the plating department. It is rather difficult for plating room control to analyze for organic salts, and this coupled with the fact that sodium citrate or tartrate are quite unstable in solution, make it more convenient to consider magnesium or sodium sulfate.

The thing we are mainly interested in, is the minimum current density that can be used to secure a good solid nickel deposit on top of pure zinc. It is understood that if this can be done that our worries as far as cadmium is concerned are about over.

Let us examine the cathode polarization curves for normal nickel solutions with added sulfates. We will find that for a normal nickel solution without the addition of a common ion it will be necessary to plate initially with a current density of about 46 amps, per sq. ft. (Dr. Graham striking bath).

Now if we add say 1 Normal sodium sulfate to the nickel solution we find that it will take approximately 20 amps. per sq. ft. to get good coverage.

Increasing this amount to 2 Normal sodium sulfate, we find, allows us to plate nickel at about 11 amps. per sq. ft. Thus by increasing the amount of sodium sulfate from 1 to 2 Normal concentration, has afforded a reduction of 20 amps. per sq. ft. and we still get good coverage. If we follow the magnesium sulfate curves we will find that almost identical results take place.

We must therefore look to the quality of nickel deposit obtained from these two solutions.

If we wish a soft ductile deposit that will withstand bending, we will find magnesium sulfate the most satisfactory of the two.

If color of the deposit is paramount the sodium sulfate will give a whiter nickel but a more brittle one.

On the other hand deposits obtained with the magnesium salt added to the solution have a slight bluish tint which may become quite objectionable if any ferrous iron is present in the nickel solution.

This brings us to the consideration of anodes.

Many platers still prefer the old 95-97% cast anodes which are excellent for their dissolving qualities. However the main objection to their use is their iron content, if they are to be used in die cast solutions.

A small percentage of ferrous iron in a die cast solution can completely undo all the good that an addition of magnesium or sodium sulfate has put into effect. In fact from actual experience in plating nickel on cadmium I might state that a good deposit of nickel could not be obtained in the presence of ferrous iron even when a pre strike has been used and I believe that is about the worst possible plating condition.

In plating room control of nickel solutions the favorite method of analyzing the solution for metal content is by titration. This is undoubtedly the easiest and quickest way to analyze the solution, but care must be exercised to keep the titrating cyanide reagent standardized at all times against pure nickel sulfate, as you all know cyanide looses its strength with age due to the formation of carbonates.

What I am driving at however, is not to find fault with the method, but rather to point out the thing that this method does not tell the plater.

For an instance I will relate a little account of just what happened when this method was used in preference to the electrolytic of metal determination.

We had experienced for some time in the summer of 1932

difficulties in covering deposits of cadmium in the recessed parts of radio condenser boxes.

In order to overcome this difficulty we were forced to change the PH of our nickel solution from 5.8 to 6.4 in order to get a satisfactory coverage. As you all know a PH of 6.4 especially in die cast solutions is quite apt to cause dark deposits of nickel as well as poor anode corrosion due to low acidity with frequent addition of nickel salts to make up for material plated out of solution.

Tremendous quantities of magnesium sulfate had been added to the solution in question with the thought in mind that possibly our cadmium deposit was slightly thin and the polarizing effect of the added magnesium sulfate would help remedy the poor covering of nickel in the recesses.

Now if we examine the cathode polarization curves for nickel deposition on the top of pure zinc, we will note that for successful plating of nickel on cadmium which is only negative to the nickel solution to the extent of -.4 volts. This should allow us to plate successfully, nickel on cadmium at extremely low current densities, and here we were, adding large quantities of magnesium sulfate to overcome an electro negative effect that did not exist.

It had been my job to analyze the solution weekly for metal concentration, but this week I noticed my titrating solution was filled with a white precipitate. So rather than use up time making up a new titrating solution it was decided to run an electrolytic nickel analysis. As you know this consists of first of all taking 5 c. c. of concentrated nickel solution, adding about 100 c. c. of distilled water and then add 20 c. c. C. P. Ammonium Hydroxide. This will cause a heavy precipitate of nickel hydroxide to form which is dissolved by the addition of 10 grams of ammonium sulfate. After electrolyzing or plating out on previously weighed platinum cathode for an hour and a half, the nickel solution is tested for nickel by taking out a drop of the electrolyte, and testing it with 10% alcoholic solution of dimethylgloxime.

Well the analysis was run as described, but when the final test came for the nickel content left in the electrolyte; contrary to

anything I had ever seen before, a huge precipitate of brownish red iron hydroxide greeted me.

A two liter beaker of the nickel plating solution was treated with ammonium hydroxide, and although a precipitate formed I believe it consisted mainly of nickel hydroxide. Next a few c. c. of 3% peroxide was tried out, and this time the entire beaker became filled with the heaviest iron precipitate I had ever seen.

Needless to say an addition of peroxide was immediately made to the plating solution, and much to our delight the dark areas in our recesses disappeared; we were able to bring our PH back to its normal value of 5.8, and from that day to this we have not made a single addition of magnesium sulfate to the solution. This I believe shows what an impurity such as iron can do to cause greatly exaggerated ideas as to the need for large quantities of this salt in nickel plating solutions for use in plating nickel on cadmium.

It had always previously been thought that a very concentrated solution of nickel salt was necessary but the absence of the iron showed this to be unnecessary also.

DUCTILITY OF NICKEL DEPOSIT.=

Much has been written about the ductility of nickel deposits, and I believe one experience in particular will be of interest to those tonight.

Before we discovered that iron was causing trouble in our nickel solution there had always been difficulty in securing a soft enough deposit of nickel on what is known as a transformer clamp.

This clamp was one of the few plated articles that was required to go through a forming operation after it had been plated. It so happened that in the particular tank that was used in plating these clamps nothing but 95-97% anodes were used.

Now the trouble I have reference to as you have probably already guessed, was the cracking off of the deposit during the forming operation.

One temporary remedy was to plate a thinner deposit of nickel. This naturally was accomplished by shortening the plating time.

As the thickness of a nickel deposit on top of a heavy cadmium coating is not extremely important, the life of the combined deposit was not lessened to any great degree.

This trouble usually occurred in the winter time when the plating solutions were naturally cooler.

A permanent remedy was effected by plating these clamps in the solution which had been treated for iron contamination by the hydrogen peroxide method.

METHODS USED FOR TESTING DUCTILITY

One of the latest methods in use at the present time is the one introduced by Dr. Vuilleumier of Dickinson College. This is called the contractometer test.

In testing the solution in question, a very thin piece of platinum is made the cathode in the experimental solution.

As the thickness of the deposit increases, if there is any iron present in the solution, the platinum will bend concave towards the anode. This deposit may be stripped (the degree of bending having been noted) and an addition of hydrogen peroxide made to the solution. Then following the same procedure the degree of bending again noted. It will be found after the iron has been precipitated the platinum will bend very slightly unless the brittleness is caused by some other factor.

If the embrittlement is caused by hydrogen gas evolution, a higher pH., or an increase of temperature will usually remedy the trouble.

If organic matter in solution is responsible, suitable oxidizing agents such as permanganate of potash or potassium chlorate may be found effective.

Dr. Lukins of the University of Pennsylvania has described a very interesting case of hydrogen embrittlement.

It seems in attempting to find a more sensitive method for this determination, a strip of electrodeposited nickel was coated on one side with collodion, and then suspended as cathode in an acid sulfate solution. The plating deposit was found to become so brittle, that on taking it in his fingers it could be crumbled into the finest kind of powder.

Deposition of chromium on nickel has this same embrittling effect. Since the deposition of chromium consists in the deposition of 85% hydrogen gas, a large quantity of the gas is absorbed by the nickel deposit and consequent embrittlement takes place causing the deposit to crack off in sharply bent areas or areas of mechanical strain.

Rhodium Plating

A Talk Delivered to the American Electro-Platers' Society
WATERBURY BRANCH

By LIONEL CINAMON, CH. E.
President of the Special Chemicals Corp.

A good many of the things I will talk about do not appear in the literature. Some of these facts are known in the industry. A good many others will be new, and the result of research and practice.

To be a pioneer in any line of endeavor is a difficult task and one is generally the target of all future research and findings. I will not intentionally give you any misleading information. Anything I say will be based on fact as far as our knowledge of Rhodium and Rhodium plating goes. Many misconceptions exist, and it is rather difficult to separate the wheat from the chaff.

Rhodium was discovered in 1804 by Wollaston. It is so named from the Greek, a rose, in recognition of the color of the dilute aqueous solution of its salts.

Rhodium occurs as an alloy in Platinum ore and Osmiridium.

The principal sources of supply are:

The river sands of the Ural Mountains, Columbia, South Africa, and in the mattes of Copper and Nickel refining in Canada. As far as the Canadian supply is concerned, the precious metals taken out in any quantity are Platinum and Rhodium.

Typical analysis of the various Platinum ores show approximately 0.5% Rhodium. A comparison of physical properties of both show:

0.5% Rh	Rh	Pt
At. Wt.	102.91	195.23
m. p.	1955° C	1755° C
b. p.	2500° C	4300° C
Sp. gr.	12.5	21.45

In the period between January 1929 to date, Platinum has dropped from $70.00 to almost $20.00 an ounce, and now sells at about $34.00 an ounce. Rhodium during the same time shows a price range of $40.00 to $55.00 an ounce.

Rhodium in the fused condition is a brilliant white metal with a blue cast, rather brittle and difficult to roll or draw. Its most frequent commercial form is a dense heavy grey powder.

Pure Rhodium unless very finely divided, is very inert and difficult to bring into solution.

Refiners of precious metals generally have the metal in solution, and sometimes work it to the proper plating salts without metalizing. A means of getting Rhodium metal into solution is to heat finely divided Rhodium intimately mixed with Sodium Chloride to redness in a Silica tube and passing moist Chlorine through during the heating. By this means the Rhodium is converted into Sodium Rhodium Chloride. Some other methods that are used in getting the Rhodium into a finely divided state, are fusions with Zinc, Lead, and Bismuth; either alone or in varying proportions with each other. The base metals are then dissolved out, and the resulting finely divided Rhodium is very susceptible to acidaction. The Rhodium in this condition is generally explosive and should be kept moist. Another method is to fuse Potassium Sulphate with the Rhodium, but I was never able to get more than a 40% conversion with this method; and because the nuisance and bother was so great, this latter process was discontinued from the start.

Rhodium is used alloyed with Platinum for crucibles, thermocouples, oxidation of ammonia gauze, contact points, and scientific apparatus. Rhodium black has been used for producing a black color in the decoration of porcelain. The electro-deposition of Rhodium has been known for many years, and is now becoming increasingly popular as an ornamental and protective coating.

Rhodium does not oxidize at room temperature, and sulphides have no effect on it. Rhodium in compact form is not even attacked by aqua regia. Rhodium oxidizes at about 500° C. Rhodium because of its inertness cannot be stripped by attacking the metal itself. It can be stripped if the metal is of an insufficient thickness, the undermetal being attacked through the pores of the Rhodium plate. The Rhodium will then come off in flakes. If we have a Rhodium plated article that can stand heat up to 500° C. then the oxidized Rhodium can easily be removed in the usual way, in fact buffing alone will sometimes suffice. Of course, if the article is full of low-melting solder, it will come apart. There are other methods of stripping Rhodium, but good judgment should be exercised. On articles of a Silver base, a Muriatic acid strip with reversed current acts more or less efficiently; however, the article will have to be refinished. Articles composed of Gold, higher karats of Gold, should be stripped in either a Nitric or

Sulphuric acid solution. For articles having a Nickel base, I would suggest Muriatic acid. The choice of acid or stripping method should be one that has the least effect upon the underlying metal. Under these circumstances the gassing and slight attack of the base metal through the pores will be sufficient to flake off the Rhodium coating.

As far as I know, the only successful commercial baths use Sulphuric acid or Phosphoric electrolytes.

In 1931 I investigated Tartaric, Benzoic, Citric, Oxalic, and Phosphate baths. But I believe the Phosphate bath is far superior to any of the so-called organic acids. I obtained passable plating baths with the Tartaric acid.

I will now discuss the advantages and disadvantages of the Sulphate and Phosphate baths. I hold no brief for either process, and what I am going to say is what I believe an honest opinion of the two.

The advantages of the Sulphate bath are:

Ease in manufacture, speed of plate, less Platinum anode area required, due to its high conductivity, and four to six volts are sufficient.

The disadvantages are:

It is generally worked about 175° F, this means an elaborate heating equipment and approximately an hour spent in heating. The spray is copious and injurious; on large installations necessitating a draw off. The Sulphuric acid is of a highly corrosive nature, attacking the tanks, clothes, and even shielded portions of the metal of the object plated. I have seen cases where sores developed on the operator's hands that could not be cured until the man laid off for two weeks; and one that became a hospital case. Sulphate baths will vary in color with the same Rhodium content, making it difficult to check for Rhodium colorimetrically. The color of the plate has a faint blue tinge that sometimes gives a leady or Chromium cast. Higher amperage is required. Best plating conditions seem to be 175° F, and approximately 2 amp/ in^2 of work. The Rhodium concentration being lower than the Phosphate bath, time, temperature, current, and the greater varying Rhodium concentration, make accurate control and uniform cost difficult.

The general advantages of the Phosphate bath are:

The color is a soft, pleasant white, and full of life. It has the exact tone or shade of a diamond. The proper Phosphate will give

a grey white and brilliant color. The color of the diamond and the Rhodium plate from the Phosphate bath blend, so that the outline of the diamond is not distinctly outlined, and makes the latter appear larger. If the Rhodium plate is towards the blue or pink tone, the diamond becomes outlined and appears smaller. All the heating equipment needed is to remove the chill from the bath. The solution is often worked at room temperature, and sometimes between 85° and 113° F, never above. The spray is very mild and no ill effects have been produced. The mild condition of the bath can best be demonstrated by keeping a finger in it for a while. Phosphate baths will vary in color in direct proportion to the Rhodium content in almost quantitative proportions. This affords an easy and quick check for Rhodium content by comparing this solution colorimetrically with standards. Lower amperage is required by using up to 1/2 ampere per square inch. The mild acid action will have no effect upon many substances that Sulphuric acid will attack.

Now let us look into the disadvantages of the Phosphate bath. Due to its low conductivity, because no effective conducting salt has been found that will not affect the color, a plating voltage of 7 to 10 volts must be maintained, depending upon the quantity of work. It takes longer to plate in the cold with customary Rhodium concentrations, although the time of plate can be regulated to give the same amount of Rhodium plate. The anode area is greater, and must be at least one to one ratio of Platinum to work. The phosphate bath is more difficult to manufacture, although easy to maintain.

Now we come to methods of testing. In testing Rhodium solutions and Rhodium deposits, there is an apparent lack of uniform procedure. Among the various tests advocated, we find pH, color, speed of plate, acid resistance, salt spray, uric acid test, Hydrogen Sulphide, Ammonium polysulphide, olives and mustard, polishing and hardness.

To run over the points involved in the aforementioned tests.

pH is acid concentration. We have found that pH in the Sulphate bath is relatively unimportant. Good plates can be obtained within a wide range. It is more critical with the Phosphate bath, and is a good check for control. The best plating range varies but 0.3pH. The range that we found most successful was 1.2 to 1.5. It is very difficult to maintain a pH in the Sulphate bath.

Color of plate is the primary object of Rhodium plating. In testing for color of the Rhodium plate, we compare the color with standards which we consider a little too blue and one that we consider a little too yellow. The perfect color is between these limits. The color of the solution serves as a reliable indication of the Rhodium content in the Phosphate bath, but it is not so reliable for the Sulphate bath.

Speed of plate is an indication of the time necessary to get a given thickness or weight of Rhodium. It also indicates whether the bath is working properly. If all concentrations and plating conditions are kept constant, a change in the speed of plate indicates trouble.

Acid resistance is used because the human body and foods are generally acidic. Why most people used Nitric acid for this test is not clear to me. It is not a body acid and is not present in food as such. Muriatic acid should be a truer indication along these lines. This test determines the compactness or porosity of the plate, since the Rhodium plate is inert to any single or mixed acid, as well as alkalies at ordinary temperatures.

The salt spray test is an indication of porosity for the same reason.

The uric acid test more nearly approaches the conditions to which jewelry will be subjected. Of course, the way the test is actually conducted, it is an accelerated corrosion test, but serves as a means of determining body effect.

The Hydrogen Sulphide gas test or any fume test is, I believe, the severest test that can be made. Electroplates that are liquid tight, will sometimes be far from gas tight. Of course, this is a test of porosity.

Ammonium polysulphide is an accelerated oxidizing test, the effect of which approaches that of air conditions. This is also a porosity test.

The olives and mustard test is sometimes used on Rhodium plated silverware to determine porosity.

The polishing test serves as an indication of hardness. Since we put a small thickness on a test strip, the hardness of the undersurface plays a very important part. The top surface of the Rhodium is torn through by the give of the undersurface. As the test is generally conducted, it merely shows the tensil strength

of a thin film of Rhodium, and the hardness of the base metal.

In testing same thicknesses or weights of various metals, Rhodium stands head and shoulders above all metals so far tested which are generally used in commercial plating. It is my personal opinion that it is fully as hard, if not harder, than Chromium for the same thickness or weight of plates.

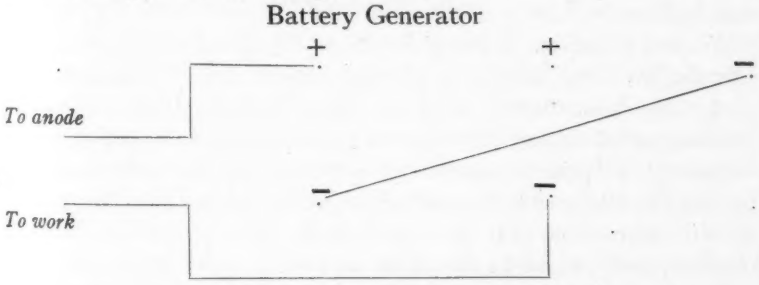
We have made all of these tests at various times. We have chosen those tests that we believe will give the best and quickest indication of the conditions under examination. To insure a uniform product, every lot that we make is tested for color of plate, speed of plate, and conductivity.

In trouble finding we generally test for pH, color of plate, speed of plate, and conductivity.

The question of increasing the voltage available without discarding the equipment on hand is sometimes a perplexing one. If there are the mechanical adjustments on the equipment, the problem is a simple one.

A very effective method of increasing the voltage of a six volt generator to ten volts is to connect a four volt storage battery in series with the generator. This makes ten volts available during the plating operation. A glass storage battery is particularly suitable for this work, because the charge and discharge pithballs, as well as the solution level are visible, and the condition of the battery can be seen at a glance.

Now if we take a double throw double knife switch and hook the outfit up in the following manner,



We can charge the battery by throwing the switch to the left when not plating, and while plating get ten volts when the switch is thrown to the right.

Instead of a manual switch, an automatic relay can be made to

throw the switch one way or the other when the plating circuit is closed or broken.

We cannot plate Rhodium directly on all metals. We have no difficulty plating on Silver, Copper, Nickel, German Silver, Platinum, Paladium, Gold, higher karats of Gold, 10k and up, not containing a high proportion of Zinc. We cannot plate directly on Lead, Tin, Antimony, Cadmium, Chromium, Iron stainless steel, or alloys of these metals; such as white metal, dye casting metal, brass, etc. To overcome this obstacle, we plate with a metal that will "take," and plate Rhodium on this underplate.

The best underplate available is Nickel because of its hardness, ease of manipulation, white color, and cheapness. Silver, Copper, Gold, and Paladium are sometimes used for underplates, depending upon plating conditions.

Rhodium plate is slightly porous. Silver is attacked through these pores, and the oxides and sulphide of Silver force their way through the pores and give an oxidized finish to the surface. This process may take months, and is objectionable. The oxidized finish can be removed by wiping, and the Rhodium plate will be there as nice as when first put on. To overcome this difficulty on Silver bases, a flash of soft Nickel is put on first, which effectively retards this action.

Two solutions of Rhodium are used, the plating and the replenishing solutions. After much experimentation, we found that in order to maintain the plating solution, we had to furnish, with the Rhodium content, only that portion of the plating salts that was lost in the "carry off."

To test Rhodium Plating Solutions for metal content, take an aliquot portion, place it in a beaker, add a little Sulphuric acid, and a few pieces of C. P. Zinc shot. The Zinc will throw the Rhodium out and go into the solution accompanied by gassing. When the solution is completely decolorized, add sufficient acid to dissolve the remaining particles of Zinc. After the Zinc is dissolved completely, boil for five minutes, filter and wash the precipitate, and weight in the usual manner.

The formula for the soft Nickel underplate for one gallon is as follows:

8 oz. Single Nickel Salts
2 oz. Epsom Salts
1/2 oz. Nickel Chloride
4 oz. Double Nickel Salts
2 oz. Boric Acid

Are You Intelligent?

By EDWARD H. TINGLEY
Secretary
National Association of Foremen

FRANK MUNSEY, head of all the Munsey publications, started life as a poor boy and when he died not over eight years ago, he left an estate of about seventy million dollars. When someone asked him how he made such a wonderful success, here was his answer:

"Well, it is just plain two and two. I look for the facts and do not fool myself."

What do you think he meant by the explanation, "It is just plain two and two?" Probably he meant that it was simple and nothing mysterious about it at all. The key to it is his next statement, "I look for the facts and do not fool myself." As most of us realize, getting the facts — the true facts and all the facts (not the opinions) is a hard job. We can easily be deceived by "half-truths" or by opinions or prejudices and are likely to even fool ourselves into believing what we would like to have happen. Frank Munsey said he did not *fool himself*.

Several years ago at a convention at Silver Bay, New York I listened to L. F. Loree, President of the Delaware & Hudson Railroad, discuss the problems of business and life, and in his talk he said, "Why it is that the individual cannot learn from the experience of the race, is absolutely beyond me." When we try to advise our sons, they tell us that times are different now from what they were when we were boys. Automobiles, radios, aeroplanes, etc. have changed life immensely and the younger fellows believe that our ideas are far out of date. Henry Ford in an article, writes:

"There are a few truths all of us know when we have reached the more mature year, and we see them to be the very foundation wisdom of life — plain, enduring and true. But when we happen to mention them in conversation we are met, if not with the words then with the spirit, which says: 'Old stuff! Give us something new!"

"What does it mean?" Simply that we do not know anything until, convinced of its truth, we act upon it. All of our going forward is simply a progress farther into the heart of principle. It is not a learning of new things but a new learning of the old."

Science and engineering is based on principles. Principles are always simple, even though they underlie all. Emerson has said:

"Without ambition one starts nothing. Without work one finishes nothing. The prize will not be sent to you, you have to win it. The man who knows HOW will always have a job. The man who also knows WHY will always be his boss. As to methods there may be a million and then some, but principles are few. The man who grasps principles can successfully select his own methods; but the man who tries methods ignoring principles, is sure to have trouble."

Doctor Myers sets up six principles or characteristics that underlie the success of the individual. He lists them in the following order:

1. *Intelligent* — your mental equipment.
2. *Dependable* — your use of this equipment.
3. *Fair* — your attitude.
4. *Pleasing* — your manner.
5. *Orderly* — your methods.
6. *Energetic* — your force.

In looking over this list, it seems that the most important characteristic of all has been left out. Where is Initiative? Is it a fundamental principle or is it a combination of several? What is initiative? Let Elbert Hubbard answer:

"Initiative is doing the right thing without being told, but next to doing a thing without being told, is to do it when you are told once."

So it looks as if initiative is a combination of intelligence, dependability and energy. Is it any wonder then, that the man who has this gift, gets the big prizes in life?

ARE YOU INTELLIGENT?

What do we mean by being intelligent? Is it the possession of a high school or college education? Is it the storing-up of facts in the brain? Intelligence has been defined in many ways, but the

simplest is "the ability to learn." Book knowledge is too often confused with intelligence. It can also be defined as the capacity to see the point, to sense relationships quickly, to "put two and two together," and to find in past experience and education, factors which are helpful in solving present difficulties.

By the ability to learn, we mean the ability to utilize the mind in two ways: through memory or the storing up of knowledge and through the ability to use this knowledge to solve new problems. Whether or not we are able to develop our own intelligence to a greater degree depends upon what extent we can train these two abilities. The development of memory only is not sufficient. One must have the sense of proper relationships between ideas and practical results.

The necessity for a high intelligence in a leader or factory executive will be readily admitted. He must select aims and purposes, coordinate his various departments, choose the right kind of men for the work to be done, to teach others the right way, to decide wisely and to get at the heart of problems shrewdly. All this must be done with confidence and without undue delay or uncertainty which will cause distrust among his workers.

Over the radio, we listen in on the man who stops people on the street and asks them a variety of questions. How many things we do not know! We miss the ordinary things that go on about us. Of course a lot of this ignorance is due to lack of observation.

For the factory man, being intelligent, is to know the essentials of the job you are working on. Most every job requires some technical skill, some scientific facts, some machinery to operate, some persons to cooperate with, some records to keep, some time limit to beat and some standard of money value for the work being done. A man can be intelligent if he knows all about his own job. Certainly he will be more valuable if he knows all there is to know about it. He will also be in line for promotion if he knows something about the job above him. Opportunities to increase our education and intelligence are offered through magazines, through conventions, through local society meetings and through visits to other shops to learn from the experience of others. There are two reasons if we do not increase our knowledge and these are:

1. *The closed mind.*
2. *Laziness, egotism and prejudice.*

The closed mind comes when you think you know it all and nobody can tell you anything. Such a mind blocks you from learning anything new and it certainly keeps you from knowing much of anything. The open mind is the opposite — it is like an unexposed negative with no notions nor prejudices to keep from getting the full picture.

Many people do not get enjoyment out of improving their minds or work, but in trying to prove that what they have done or are now doing, is right. So when you try to tell them something that would make them more intelligent, they listen with about one tenth of their mind. With the other nine-tenths, they are thinking hard how they are going to answer you to prove what they have been doing is right. And then if they can possibly brow-beat you or in any way convince you that they are right, then they are happy. As a matter of fact, they should be sad, because they should know that they can never make progress unless they do learn something new or a better way to work.

What closes the mind? The same things that make it hard for some people to work well with others: Egotism, Laziness, Unconcern, Satisfaction and Prejudice. Perhaps the strongest influence of all of these is prejudice, for when we are prejudiced against anything, we do not want facts — we want our preconceived opinions, although perhaps these opinions are founded on no real facts at all. As Mr. C. F. Kettering said: "The moment you are satisfied, the concrete has begun to set in your head."

Our brain is, of course, the major tool we bring to the task of living. We profit if we keep our brain adjusted to the tasks ahead of us and not let it deteriorate through improper use. Glenn Frank tells us the FOUR MARKS OF A FINE MIND, to be:

"First, *humility*. A first-class mind is never cocksure; it is always willing to admit that it may be wrong; it is never afraid to say that it does not know; it does not specialize in closed questions; all questions are open questions to it; it is always ready, in the presence of new knowledge or fresh challenges, to question the soundness of its earlier observations and the sanity of its earlier conclusions.

Second, *curiosity*. A first-class mind is never satisfied with surface observations; when, in its humility, it has admitted that there is a question to be considered, it turns a restless and ruth-

less curiosity on the question; it is never satisfied with a sweeping judgment; it ferrets out every detail and tries to see just what bearing each detail has on the whole question.

Third, *courage*. A first-class mind is marked by a subtle blending of courage and imagination, the result of which is that it takes the results of its analysis of a problem it has worked over and puts them into various new combinations in an effort to find some new and better theory for action; it is willing to follow a new idea, if it is sound, even if it upsets former notions and former ways of doing things.

Fourth, *responsibility*. A first-class mind has a sense of resonsibility in handling its new theories; it puts them through all sorts of tests to prove both their logical soundness and their practical utility."

Frederick S. Magnus

The many friends of Frederick S. Magnus, Vice President and Treasurer of Maas and Waldstein Company, Inc., Newark, N. J. will regret to learn that on February 16 he died of heart failure after an illness of several months.

Mr. Magnus, who was 66 years old, came to this country from England a half century ago. He joined the Maas and Waldstein organization in 1911, and in 1914 was made Vice President and Treasurer.

Always active in the management of his own company, Mr. Magnus became a prominent figure in the American lacquer industry, where he gained widespread recognition for his high ideals of business ethics and his great practical knowledge. His opinion and advice were constantly sought by those concerned with al phases of the finishing industry.

The Abstract Section

PATRICK J. SHEEHAN, *Chairman, Program and Educational Committee*

Laminated Chromium Deposits — By R. J. PIERSOL, PH. D. *Metal Cleaning and Finishing*, December, 1935 — Internal stresses of electro-deposited metals from aqueous solutions are generally attributed to the absorption of hydrogen. Since the ductility of chromium electro-deposits is low, the development of high internal stresses will tend to peel such deposits from the base metal. The great advantage of laminated deposits lies in the fact that internal stresses are not transferred from lamination to lamination. The author describes several experiments using definite plating and removal periods. Descriptions of the technique involved will be given in a later article.
E. T. SHEEHAN

Gold Plating Methods — By W. A. KOEHLER. *Metal Cleaning and Finishing*, December, 1935 — The decorative uses of gold plating are well known. Because of its resistance to most reagents it has found use as a protective coating on scientific apparatus. Since fold is low in the electromotive series, its protective value is mechanical and dependent on the density of the deposit. Gold plating may be accomplished by electroplating, salt water plating and dip plating. Formulas for the above methods, type and value of deposits, etc., are fully described. E. T. SHEEHAN

The Hardness of Electrolytic Chromium (Die Härte des Elektrolytischen Chroms — Einfluss der Stromdichte und der Temperatur auf die Löslichkeit von Wasserstoff in Chrom und auf dessen Härte) S. P. MAKARIEWA and N. D. BIRUKÖFF — *Zeitschrift für Elektrochemie* Vol. **41**, 1935, pages 838-842) — The influence of the temperature of the electrolyte and the current density on the hardness of electrolytic chromium was studied together with a correlation of the amount of dissolved hydrogen and the corresponding hardness. The amount of hydrogen dissolved is also dependent upon the hydrogen overvoltage. The volume of hydrogen dissolved varied from 30 to 100 times the volume of the chromium depending upon the conditions of deposition. The amount of dissolved hydrogen did not determine the hardness as, for example, the highest value for the solubility of hydrogen was obtained at a current density of 250 amperes per square foot whereas the hardness decreased as the current density rose from 70 to 1100 amperes per square foot. The solubility of hydrogen in chromium increases with temperatures up to 35°C, decreases from 35°C to 40°C and then increases again with temperatures above 40°C. The only correlation between hardness and amount of dissolved hydrogen occurs between 35° and 40°C which indicates that these two factors are dependent upon a third factor which may be the size of the crystals or the amount of hexagonal crystal formation. W. R. MEYER

METALS AND ALLOYS ABSTRACTS

1. **A Study of Al - Hg - Zn Anodes in Acid Zinc Plating Baths.** By A. K. GRAHAM and P. G. KOLUPAEV — A study of Al - Hg - Zn anodes in a zinc sulfate, aluminum sulfate and ammonium chloride bath at Ph values of 2.0 to 4.0 and three other acid zinc baths of commercial composition at a ph of 4.0, has been made. Temperatures as high as 50°C (122°F) and anode current densities as high as 300 amperes per square foot have been employed. Current efficiencies, anode polarization and sludging tendency, bath voltage, Ph variations and character of deposits are reported. Typical bath at Ph of 4.0 with Al-Hg-Zn anodes at current density from 20:100 amperes per square foot has anode efficiency of 99% and a polarization of only 0.2 volts and is free from undesirable sludging. If cathode current density is below 45 amperes per square foot, cathode efficiency is 99%. PHIL J. RITZENTHALER

2. **Finishing Zinc and Aluminum Die Castings.** H. CHASE "*Machinery*" Vol. **42**, Oct. 1935 - pp 120-122 — Die castings are often finished by plating, lacquering, enameling, japanning or varnishing. Various methods for preparing the castings for these finishes are described. Nickel is recommended as the base coating on aluminum and usually on zinc castings zinc parts exposed to weather should receive first a copper coat of 0.0005" followed by 0.0003" to 0.0005" of nickel and 0.000025" chromium.

PHIL J. RITZENTHALER

3. **The Acid Pickling of Non-Ferrous Metal Components.** P. MABB "*Machinery*" London Vol. **46** - Aug. 29, pp 661-3 — Pickling is usually performed in two steps, first, slow pickling to remove surface material and rapid second step to give final surface. Importance of degreasing is stressed and tri-chlorethylene or alkali bath is recommended. Procedure given for copper brasses, bronzes, nickel and alloys, aluminum and alloys, zinc alloys in various pickling procedures. PHIL J. RITZENTHALER

The Lea Manufacturing Co., Waterbury, Conn., now carry a comprehensive stock of Merck Laboratory Chemicals. They are in a position to supply these chemicals to consumers in Connecticut and nearby parts of Massachusetts.

TO OUR CONTRIBUTORS

We are receiving many splendid articles which were read at various branch meetings lately.

Since we are anxious to publish all papers read at the Bridgeport Convention before June 1st we may not be able to print the articles recently received in the immediate future. We assure our friends however that they will receive attention just as soon as space permits.

W. J. R. KENNEDY, *Editor.*

Business and Social News — BRANCH NEWS — Educational Activities

SPRINGFIELD BRANCH

In order to become better acquainted with each other's families, the Springfield Branch had a social get-together on Monday Evening, Feb. 3, at the Indian Motocycle Club Rooms. Mr. R. Leather, president of of the Lea Manufacturing Co., Waterbury, Conn., was invited to be one of our guests and entertained us for an hour with moving pictures of the recent Bridgeport Convention and other scenes.

Another old friend, Bill Stoddard, of the Hartford Branch, who is connected with the Egyptian Lacquer Co., brought his "House of Magic" along, and kept everyone amused and excited with the stunts he pulled off.

The Springfield Branch is deeply indebted to these two members of neighboring branches for their cooperation and entertainment. Refreshments were served at the close of the meeting.

The regular meeting of Springfield Branch was held on Monday Evening, Feb. 24, at the regular meeting place on State St.

Mr. Rudolph E. Marshall, Worcester Brass and Electroplating Co., applied for membership as an active member. It was voted to have the application take the usual course.

Routine business was discussed and acted upon.

The Tingley article appearing in the February REVIEW was read and discussed by every member present. During the discussion it was suggested that these articles be passed from one foreman to another as is the custom in many factories in the East.

H. R. DELARM, *Sec.*

NEW YORK BRANCH

The New York Branch held two scheduled meetings during January at which special subjects of avowed interest were treated by distinguished lecturers of the electro-chemical fraternity.

On Friday, January 10th, Dr. Alpern of Brooklyn College, Brooklyn, N. Y., presented for the interest of the membership facts of the development to date of a complex Ion solution using iodine as a substitute for the cyanides in gold and silver solutions. The subject matter of this discourse being substantially new it created a great interest and much questioning on the part of the membership after the course of the lecture. Dr. Alpern is to be congratulated on his ability to put his subject before the plater in an understandable manner.

On Friday, January 24th, the Branch had the opportunity of listening to one of the most interesting illustrated lectures ever given at New York Branch by one of the foremost members of the American Electro-Platers' Society and authority in the electro-plating field, Mr. George Hogaboom of the Hanson-Van Winkle-Munning Company. His subject was his well known one "What is under the Plate." Mr. Hogaboom showed conclusively the reasons for much of the dissatisfaction with plated finishes did not rest with the plater but rather were metallurgical problems. The membership extended Mr. Hogaboom a rising vote of thanks for his splendid effort.

The February 14th meeting was a

business meeting at which several Branch matters were taken up and discussed and an application for membership was filed.

On Friday, February 28th the Branch will be favored by a visit from Dr. Wachsmuth of the Revere Copper & Brass Company, Research Department, who will lecture on the subject of "Soluble Anodes". His coming will be awaited with interest.

New York Branch regrets the loss of two old members of this Branch — Mr. Joseph A. Straub (active) of 309 East Mosholu Parkway, New York, N. Y., who died as of February 8, 1936, and Mr. James R. Egan (honorary) of 24 Greenwood Ave., Bethel, Conn., who died in September 1935 but whose demise was not made known to us until February 14 by indirect communication.

An application is filed for membership in this Branch by Mr. Walter C. Benkert (active) of 291 Central Ave., Brooklyn, N. Y.

F. J. MACSTOKER, *Sec.*

MILWAUKEE BRANCH

The Milwaukee branch held its regular meeting, February 13, 1936, Pres. Robt. Steuernagel in the chair. An attendance of twenty-five was present. This was very good considering the sub-zero weather and the heavy snowfall. Two applicants were elected members Mr. Everett Robinson, active, and Mr. Robert Goodsell, associate. Two applications were received for membership: Mr. Vincent Sheehan and Mr. Bernard Wesolowski, both associate.

The smoker committee report they will have the finest educational meeting, March 21, Milwaukee has ever had. Three nationally known men, Mr. Geo. Hogaboom, Hanson Van-Winkle-Munning Co. will talk on: "Protective Coatings for Metals." This talk will be illustrated. Mr. C. Clendinin, Crown Rheostat & Supply Co. will talk on, "Are Operations Prior to Plating Important. "Mr. Oliver Sizelove, The Frederick Gumm Chemical Co. will talk on: "Bright Nickel."

The hotel room has been changed from the Crystall ball-room to the Green room. Members! attention, this room will hold four hundred people comfortably — bring your superintendents and anyone else interested in plating.

The speaker of our educational meeting was Mr. Sheehan (Bud) son of our Supreme Vice-President, Pat Sheehan, who talked on: "Chrome Plating." The way he held his audience was proof that the effort he put in on his paper was not in vain.

R. C. BINDER, *Sec.* & *Treas.*

Mr. Charles B. McCloskey

It is my sad duty to report the death of Mr. Charles B. McCloskey, an associate member of Pittsburg Branch, application being made on March 31, 1925, and he has been a loyal member ever since. His death on Tuesday, February 11th, in the hospital at Bellevue, Pa., was due to a kidney trouble. He leaves his wife and two sons.

He has been connected for many years with the Roessler & Hasslacher Chemical Co., and with the E. I. duPont de Nemours & Company, as Pittsburgh Sales Manager.

Pittsburgh Branch will miss him, he was always ready to do his part in the many things that worked for the best interest of all the membership.

He was laid to rest in Brooklyn, N. Y.

S. E. HEDDEN, *Sec.-Treas.*

WATERBURY BRANCH

Regular meeting of Waterbury Branch A. E. S. was held on Friday evening, February 14th in Engineers' Hall. Librarian Ellsworth Candee presided at the meeting. Communication was received from the Bridgeport Branch, calling attention to the Educational Session and Banquet to be held at the Stratfield Hotel, Saturday, March 14th. Favorable action was taken on the application of John S. Dixon of New Britain and he was declared elected to associate membership.

After routine business had been transacted Chairman Candee introduced the speaker of the evening, Mr. N. Promisel, Engineer of the International Silver Co. of Meriden, who spoke on "The Structure of Electro Deposits and Basis Metal Surfaces." Mr. Candee assisted the speaker with lantern slides which brought out many points of the address very convincingly. From start to finish the talk was very interesting and proved to be a treat for all present. A vote of thanks was extended Mr. Promisel at the conclusion of the address and discussion.

The chairman of the entertainment committee announced that another interesting speaker had been secured for the next meeting, which will take place Friday evening March 13th.

Mr. and Mrs. Archie MacDermid have left for Miami, Florida. Mr. William Delage of the local Branch has been sojourning in Florida for some weeks past.

W. F. GUILFOILE, *Sec'y.*

ANDERSON BRANCH

Anderson Branch met at 8:00 P. M. at the Y.M.C.A. All officers were present and we were gratified to see the faces of almost all our new members.

Following the secretary's report, a letter from Mr. W. M. Phillips, chairman of the Research Committee was read. President Castel appointed a committee, Messrs. C. D. Cleaver, R. M. Wagner and Guy Cole, to function on this matter.

A very interesting discussion was given by Mr. Castel on a new barrel plating layout, including a diagram of plating equipment and dryers. Bright-Zinc was also discussed with much interest by members.

Plans for future meetings were considered and a motion was made and carried to have two meetings a month —one dinner meeting with an outside speaker and guests, and an educational meeting for members only. We expect to conduct a class in 'Plating' at the closed meeting.

After setting the date of the next

EXPERIENCED ELECTROPLATERS

prefer

ANACONDA

Copper Anodes

...because their unexcelled purity assures uniform corrosion, the highest quality deposit in the shortest possible time and low scrap losses. Furnished with suspension holes drilled as desired, or tapped for end hooks.

ANACONDA

THE AMERICAN BRASS CO.

General Offices, Waterbury, Conn.

Offices and Agencies in Principal Cities

meeting as Feb. 17th, meeting adjourned at 9:30 P. M.

Anderson Branch held its bi-monthly meeting at the Y.M.C.A. Due to ice and snow only about one third of our members were present.

At the February 3rd meeting, plans were made to have two meetings each month, the second being devoted mainly to classes in 'Practical Plating'. The subject reviewed and discussed at this meeting was Nickel Solutions. Much time was given to the new bright nickel, members reporting many headaches to each 100 gallons of sloution.

A resignation from our librarian, Mr. G. S. Cole was read and due to his being transferred to another city, was regretfully accepted.

The application for associate membership in Anderson Branch of Otto McCallister was voted accepted.

Due to some of our members reporting failure to receive the Monthly Review, the secretary was instructed to furnish the Editor a revised list of members' addresses.

Plans were discussed relative to our March 9th dinner meeting at which our old friend George Hogaboom will be the principal speaker.

Meeting adjourned at 9:30 P. M.

J. W. MINTON, *Sec.*

DETROIT BRANCH

A regular meeting of the American Electro-Platers' Society, Detroit Branch was held Friday evening, February 7, in Hotel Statler, Detroit, at 8:00 P. M., with W. W. McCord, President, presiding.

There was a very good attendance.

The Minutes of previous meeting were read and approved.

There were three applications for membership received and turned over to the Board of Managers as follows: J. H. Monaweck, 660 Hazelwood, Detroit, Mich., Eric G. Sampson, Jr., 15845 Steopel Ave., Detroit, Mich., Roy A. Johnson, Room 211, 1627 W. Fort St.

Also the application of Associate Membership of Mr. Edwin Lacey was reported on by the Board of Managers as favorable and he was unanimously elected to membership

Mr. Geo. Fry, 512 W. Chestnut St., Lansing, Mich., Suspended.

The meeting was then turned over to the Educational Committee, who had as Speaker for the evening, F. F. Oplinger of the E. I. Dupont de Nemours Division, and his subject was "Zinc Plating" — and did he know his stuff? I'll say he did. There is no copy at the present time of his paper, but I will have one in the near future and send it in for publication. A great many questions were asked and answered, and quite a few problems in zinc plating were thrashed out.

Suffice it to say the adjournment did not take place until 11:30 P. M.

At our next meeting we expect to have our illustrious and very well informed member of the Bureau of Standards at Washington, Dr. Blum, who will give us a talk on the activities of the Bureau regarding electric deposition of metals.

We expect to have a Joint Meeting with the Society of Heat Treaters and also the American Electro-Chemical Society, and anticipate having a very good attendance.

T. C. EICHSTAEDT, *Sec.-Treas.*

CHICAGO BRANCH

The regular meeting of Chicago Branch was held Feb. 8, 1936 at the Atlantic Hotel.

President F. Herbst presiding and all other Officers present except our librarian Mr. O. E. Servis who had met with an auto accident in which he received a broken arm and several other bruises. Chicago branch, Officers and members extend their best wishes to Mr. Servis and hope that he will have a rapid recovery back to health.

Mr. E. H. Lyons Jr. and Mr. J. S. Edwards were elected to Associate membership and Mr. L. B. Doll and Mr. G. A. Bock Jr. were elected to active membership.

Mr. H. A. Gilbertson chairman of the banquet committee read a very fine report on the Banquet and thanked all the officers and members and supply companies for making this the largest and one of the finest banquets ever held by Chicago Branch.

Mr. Gilbertson acted as librarian and found the following questions in the question box.

No. 1. *Is there any advantage in plating sheet steel in a Nickel Cobalt solution, over straight nickel plate on steel? Which is the more expensive nickel or the nickel cobalt solution?*

Answer. There is no advantage in plating nickel cobalt solution over straight nickel for rust purpose. The nickel cobalt is the most expensive.

No. 2. *Which is the best way to bronze plate steel? Copper plate and buff, then bronze plate or bronze plate direct on the steel and buff? What is the best anodes for a bronze solution.*

Answer. Many suggestions offered but thought that steel could be bronze plated direct and buffed with good results. Anodes of 92% copper 8% zinc.

No. 3. *In order to get out a rush job and yet not have to go to the investment of nickel anodes for only a few days can steel anodes be used if the Metal content is kept up?*

Answer. It can be done but is not recommended, but pH should be on the alkaline side to avoid trouble.

J. HANLON, *Sec'y*

STANLEY

CARE

The same care, thought and planning that goes into the manufacture of your product requires the selection of a proper coating — one prepared to meet your specific requirements.

May we serve you ?

LACQUERS - SYNTHETICS - ENAMELS
JAPANS

THE STANLEY CHEMICAL COMPANY
EAST BERLIN, CONN.
A Subsidiary of The Stanley Works
New Britain, Conn.

CLEVELAND BRANCH

The regular monthly meeting of the Cleveland Branch of The American Electro-Platers Society was held at Hotel Carter, Saturday, February 1, 1936.

The meeting was called to order by our president Mr. Scott at 8:15 P.M.

The minutes of the previous meeting were approved as read.

A letter from The Cleveland Branch of The American Electro Chemical Society inviting us to attend a meeting Thursday, March 5th, at which time

INDUSTRIAL CLEANING MATERIALS

for ALL Purposes

●

METEX

Metal Cleaners

●

PLATING EQUIPMENT
BUFFING COMPOSITIONS
UDYLITE CADMIUM SERVICE
COMPLETE CHEMICAL SERVICE

●

MacDermid Incorporated

WATERBURY, CONN.

Please mention THE MONTHLY REVIEW *when writing*

they would have Dr. Blum of The Bureau of Standards address them on "Specifications and Tests for Electroplated Coatings." The secretary was ordered to notify members.

The ladies were then invited in as the balance of the evening would be about our coming convention.

Mr. Thompson of the Publicity Committee reported about having stickers printed to put on letterheads. He had a sample of these stickers which he passed around and received a price of $60.00 for 30,000.

Mr. Thompson reports progress. The other chairman all report progress.

The meeting was then turned over to the Budget Committee.

After some discussion a motion was made to have a special meeting February 15.

Motion was then made to adjourn.

W. E. O'BERG, *Sec.-Treas.*

HARTFORD BRANCH

The Hartford Branch of the A.E.S. held its regular monthly meeting on Monday evening, February 10, 1936, at the Elk's CLUB in Bristol, Conn.

The meeting was called to order at 8:30 P. M. with Pres. St. Pierre in the chair. Minutes of the previous meeting were read and accepted. All communications were read and placed on file. One bill amounting to fourteen dollars and seventy-cents ($14.70) for our third Quarter Per Capita Tax was voted paid.

Mr. Walter Rowe, foreman of the North & Judd Co. of New Britain, Conn. gave a very fine talk on "Special Barrel Finishes." He had many samples of his work with him which were very good.

After much discussion which lasted until a late hour, Mr. Rowe was given a rising vote of thanks for his very interesting talk.

The meeting was attended by eighteen members and was adjourned at 11:15 P. M. V. E. GRANT, *Sec'y.*

LOS ANGELES BRANCH

Minutes of the Los Angeles Branch A. E. S. regular monthly meeting held at the Rosslyn Hotel, Jan. 8. 1935.

Pres. E. R. Williams presided. There were 12 members and 3 visitors present.

The minutes and financial report of the previous meeting were read and accepted.

M. D. Rynkofs reported for the committee arranging details of the card party the Branch had planned for Feb. 22nd. He reported that the committee had completed all arrangements and the party would consist of dinner followed by card games.

The board of managers reported favorably on the application of F. L. Ferguson for membership in the Society. Mr. Ferguson was elected an active member.

The secretary read applications for membership by H. A. Mills and Raymond Solivan. These applications were turned over to the board of managers for approval.

The meeting was turned over to Ray Bray the librarian. He found the following questions in the box:

Q. Can die castings be chromium plated without first nickel plating?

A. Yes, but the idea is not practical. Chromium alone would give very little protection.

WANTED to buy for spot cash a mailing list of firms doing oxidizing. Potential users of McKeon's "The Oxidizing Agent of Today". — Sulphur Products Co., Inc., Greensburg, Pa. *Liquid Sulphur*

TRADE
MATCHLESS
REG. U.S. PAT. OFFICE
MARK

IT IS NOT NECESSARY
TO HAVE
BUFFING PROBLEMS

MANY OFFER TO "SOLVE" YOUR PROBLEMS — WE GUARANTEE TO "PREVENT" THEM

INSIST UPON
MATCHLESS HIGH GRADE
BUFFS
and
BUFFING COMPOSITIONS

There is no substitute for "MATCHLESS"

THE
MATCHLESS METAL POLISH CO.
840 W. 49th Pl. Chicago, Ill.
726 Bloomfield Ave. Glen Ridge, N. J.

A book for those who clean metal

"THE METAL CLEANING HANDBOOK" is intended to provide a ready reference and guide for the use of those directly interested in or concerned with metal cleaning.

To these a limited number of copies are available. A request on your business letterhead giving your official title or position will bring a copy. To all others, a copy will be sent on receipt of the nominal sum of $1.00 to cover the cost of publication.

MAGNUS CHEMICAL COMPANY
41 South Ave. Garwood, N. J.

Magnus
CHEMICAL COMPANY

THIS IS THE EMBLEM
OF
STANDARD QUALITY
IN
FINISHES

Write for a sample of our new line of METALLIC LACQUER ENAMELS. Furnished in: Gun Metal, Gold, Silver, Bronze and Pastel Shades.

Another item that should interest you is our CHROMIUM PRIMER. Adheres tenaciously to Chrome Plate.

If you have a finishing problem, consult us.

H. V. WALKER CO.
ELIZABETH NEW JERSEY

Q. What causes a heavy sludge on bottom of chromium solution?

A. No definite answer. It was suggested that the sludge may be a precipitate of lead chromate.

Q. How is black chromium produced?

A. No one present had had any experience with this type of plate. It was suggested that sodium hyposulphite be used in place of part of the sulphuric acid normally used in a chromium solution.

Q. What causes a nickel plate to be rough when applied to work that has previously been cleaned in a combination cleaner and copper strike?

A. Probably too much metal in the strike or work plated in the strike too long.

Q. What will clean the oxide off from brass, the oxide being caused by soldering acid?

A. Use any mild cleaner. Work may have to be scratch brushed.

One of our visitors was Mr. Neil Jones, a chemist, who took an active part in all our discussions and gave us some very good pointers which we all appreciated.

EARL COFFIN, *Sec-Treas.*

BINGHAMTON-ELMIRA BRANCH

The regular meeting was held Feb. 3. Our president Austin Fletcher presided. Dinner was served at 6.30 P. M. to 50 members and friends. After a brief business session Mr. Fletcher welcomed a number of members from other branches. Our members were glad to make the acquaintance of Mr. Sizelove, Mr. Gumm and Mr. Hilgenberg of Newark Branch, Mr. Hannecher of Rochester, Mr. Cole of Anderson and Mr. Todd.

The speaker for the evening was Mr. O. J. Sizelove who gave us a very interesting talk on Bright Zinc Plating. After many questions the meeting went into a general discussion on plating with Mr. Sizelove being kept busy until the meeting adjourned at 10 P. M.

Each meeting shows an increase in interest in our Branch. After the meeting four men requested application blanks. Binghamton Branch is going places.

A. FLETCHER, *Pres.*

ST. LOUIS BRANCH

The Educational Session and Banquet of our branch held at York Hotel on February 1st was among the best ever held.

After a vacation of five years, we came back in usual form. This was largely due to efforts of our permanent committee chairman Mr. E. J. Musick, assisted by Messrs. Terrio, Daw and Chandeyson.

In the afternoon Mr. H. W. Kennedy of the Grasselli Co. presented a paper and gave an exhibit of "Bright Zinc."

Dr. L. E. Stout of Washington University read a paper on "A Critical Study of Bright Nickel" and Mr. W. M. Phillips of General Motors Research and Chairman of A.E.S. Research Committee gave us his illustrated talk on "Pictorial Study of Electro-plating."

Mr. F. N. Weber, President of St. Louis Branch presided at this session.

In the evening the dinner, the floor show and the dance music kept the big crowd lively till past midnight.

Many valuable attendance prizes were given.

Last, but not least, Hedley Richards came across with some of his original poetry, which is always well received.

CHAS. T. MCGINLEY, *Sec.*

RELIANCE PORTABLE PLATING BARREL

(PAT.)

A complete unit which can be suspended in any plating tank at least 24 in. x 18 in. x 10 in. deep. Capacity of barrel one peck of light stampings or 30 lbs. of screw machine products.

Size of barrel 10 in. x 18 in. Weight 32 lbs. Barrel is made of materials which are acid and alkali resisting and non-absorbent. Can be used with all standard solutions except chromium; also with strong cleaners; and at temperatures up to 150 deg. F. Furnished to operate from A. C. circuit 110 or 220 volt, or from 6 volt D. C. plating circuit.

Write for Circular

CHAS. F. L'HOMMEDIEU & SONS CO.

MANUFACTURERS
EQUIPMENT AND SUPPLIES
FOR PLATING AND POLISHING

4521 OGDEN AVE. — CHICAGO — 15 S. CLINTON ST.

BRANCHES: CLEVELAND, LOS ANGELES

DEALERS IN PRINCIPAL CITIES

MILWAUKEE BRANCH

Annual Educational Meeting and Smoker

On Saturday evening, March 21st at 7:30 P. M., Milwaukee Branch A. E. S. will hold their annual Educational meeting and Smoker at the Hotel Schroeder (Green Room), Corner N. 5th Street and Wisconsin Avenue, to which you are cordially invited. The committee has arranged a fine Educational meeting; three nationally known speakers will present papers on the latest development in the Electroplating field.

I. *Bright Nickelplating*
by OLIVER J. SIZELOVE, Frederick Gumm Chemical Co.

II. *Are the Operations Prior to Plating Important?*
by C. CLINDININ, Crown Rheostat and Supply Co.

III. *Protective Coatings of Metals*
by GEO. HOGABOOM, Hanson-Van Winkle-Munning Co.
This talk will be illustrated.

The Educational meeting will be followed by a Buffet Lunch and refreshments for which Milwaukee Branch is famous. A high class entertainment will close the session.

A small fee of $2.00 per person will cover all expense. All persons interested in electroplating are invited.

MILWAUKEE BRANCH A. E. S.
Smoker Committee
DAN WITTIG, *Chairman*
1221 N. Third Street

You can't Finish me... I'm too tough!

We've heard that line before . . . Not from a "pug" however, but from manufacturers with a finishing problem.

We've been in the ring with many a tough one . . . Some we have knocked out pronto . . . Some have extended us to the limit . . . But we have usually won. We're well trained for the fight . . . Been at it for over fifty years so we are always in shape.

Maybe you have a problem of finishing that you want to match with us. We won't promise to whip it because solutions to some problems are impossible and yours may be one of that kind. But we will guarantee we won't toss in the towel until we have stayed a sufficient number of rounds to know that your problem is too tough . . . And if we can't lick it, we will be willing to crown whoever does as the new champ . . . That is, if you can find some one who qualifies.

Let us know when you are next in the market for lacquer finishes. We'd like to talk to you.

EGYPTIAN · LACQUER

THE EGYPTIAN LACQUER MFG. CO. • 90 WEST STREET • NEW YORK, N. Y.

Membership Report

To February 18, 1936

ELECTED

Frank Enscott, 177 Westlake Ave., Toronto, Canada
Active, Toronto Branch

Harry Hands, 266 Mortimer Ave., East York, Toronto, Canada
Active, Toronto Branch

John McLean, 4 Ottawa Street, Toronto, Canada
Associate, Toronto Branch

Harry Bird, 58 Lacey Ave., Toronto, #9, Canada
Active, Toronto Branch

Edwin Lacey, 11 McLean Ave., Highland Park, Mich.
Associate, Detroit Branch

Everett N. Robinson, 2628 N. 70th St., Wauwatosa, Wis.
Active, Milwaukee Branch

Robert Goodsell, 312½ St. Patrick St., Racine, Wis.
Associate, Milwaukee Branch

Russell F. Smith, Motor Lamp Mfg. Corp., Anderson, Ind.
Active, Anderson Branch

Ernest H. Lyons, Jr., 1629 S. 55th Ave., Cicero, Ill.
Associate, Chicago Branch

George A. Bock, Jr., 177 East Marion St., Elkhart, Ind.
Active, Chicago Branch

LeRoy B. Doll, 631 Terrace Ave., Bethlehem, Penna.
Active, Chicago Branch

John Stanley Edwards, 2449 S. California Blvd., Chicago, Ill.
Associate, Chicago Branch

Fred Leland Ferguson, 202 N. Florence Ave., Monterey Park, Calif.
Active, Los Angeles Branch

F. Eriscott, 177 Westlake Ave., Toronto, Ontario
Active, Toronto Branch

H. Hands, 266 Mortimer Ave., Toronto, Ontario
Active, Toronto Branch

J. McLean, 4 Ottawa St., Toronto, Ontario
Active, Toronto Branch

H. Bird, 58 Lacey Ave., Toronto, Ontario
Active, Toronto Branch

DIED

Joseph A. Straub, 309 E. Mosholu Parkway, New York, N. Y.
New York Branch

James R. Egan, 24 Greenwood Ave., Bethel, Conn.
Honorary Member, New York Branch

HARSHAW ANODES AND CHEMICALS

FOR DEPENDABLE QUALITY PLATING.

Insist on Harshaw Analyzed Anodes and Chemicals . . . They are guaranteed purer than the Bureau of Standards and any commercial specifications we have ever seen.

Immediate shipment . . . from a pound to a carload.

HARSHAW QUALITY CHEMICALS

THE HARSHAW CHEMICAL COMPANY

Manufacturers, Importers, Merchants

Offices and Laboratories: CLEVELAND, OHIO

Quality Products Since 1892

New York, Philadelphia, Chicago, Detroit, Pittsburgh, Cincinnati, East Liverpool, Los Angeles and San Francisco

Works: Cleveland, Philadelphia, Elyria

Please mention THE MONTHLY REVIEW *when writing*

MEMBERSHIP REPORT—Continued

DIED

Charles B. McCloskey, Pittsburgh, Pa.
Member Pittsburgh Branch

John Shaw, 4542 Patricia Ave., Montreal Canada
Montreal Branch

APPLICATIONS

J. H. Monaweck, 600 Hazelwood, Detroit, Mich.
Detroit Branch

Eric G. Sampson, Jr., 15845 Steopel Ave., Detroit, Mich.
Associate, Detroit Branch

Roy A. Johnson, Room 211, 1627 W. Fort St., Detroit, Mich.
Detroit Branch

M. Vincent Sheehan, 1319 N. 23rd St., Milwaukee, Wis.
Milwaukee Branch

Bernard Wesolowski, 2478 So. 15th St., Milwaukee, Wis.
Milwaukee Branch

F. Wahlen, 6333 S. Paulina St., Chicago, Ill.
Chicago Branch

W. Radunz, 4725 Castello Ave., Chicago, Ill.
Chicago Branch

Walter C. Benkert, 291 Central Ave., Brooklyn, N. Y.
Active, New York Branch

Rudolph E. Marshall, Worcester Brass & Electroplating Co.,
Worcester Mass., Active, Springfield Branch

RESIGNED

Mr. Edw. Fleming, Active, Hartford Branch

Emory Malo, 37 Winter St., Taunton, Mass.
Providence Branch

SUSPENDED

George Fry, 512 N. Chestnut St., Lansing, Mich.
Detroit Branch

The Lea Mfg. Co., Waterbury, Conn. producers of LEA COMPOUND, LEAROK and LEA NICKEL GLO announce an added service to the plating industry. Extensive facilities have been installed for coating plating racks with KOTE-RAX, a tough, translucent, rubber-like compound with high corrosion resisting properties and dielectric strength. Being immune to attack from the solutions commonly used in plating chromium, cadmium, silver, nickel, etc., KOTE-RAX greatly reduces maintenance on the equipment and replacements by providing the equipment with a durable protection by preventing disintegration and metallic deposits. It neither contaminates the solutions nor takes a plate. It can be applied to old as well as new plating racks. Minor abrasions can be easily repaired by the user. Re-coating can be handled best by a shop with complete facilities such as The Lea Mfg. Co., now has available.